Geodimeter® CU 2

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Trimble

Geodimeter® CU

User Guide Part 2

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Welcome to Geodimeter CU

This manual will describe the different softwares that can be installed in Geodimeter® CU.

Since Geodimeter CU have flexible design it is possible to upgrade software, memory units and other accessories. The various softwares makes it possible to customize your system to your own way of working.

The built in two-way serial communication enables you to connect external memory units and computers to the instrument.

About this manual

The contents of this manual are as follows:

Part 2

Includes available softwares and contains step by step instructions on how to use each software.

Comments about this manual

If you or your colleagues have any comments on this manual, we would be grateful to hear from you. Please write to:

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CHAPTER

1

Software

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Introduction

Geodimeter CU can be equipped with a number of different software in order to make the surveying work more efficient. This manual will describe the different softwares that are available, how they are operated and what you can achieve by using them.

Choose Program

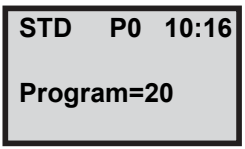
Both the numeric- and the alphanumeric keyboard are equipped with a program key, here after referred to as the PRG-key.

Program key

By pressing this key you can start any program that are installed in your instrument. There are two ways to choose a program; short press and long press on the PRG-key. On the next side we will describe the two different methods.

Short Press

With a short press on the PRG-key you will get the following display appearance:



Key in the desired program number and press enter to confirm the choice, e.g. 20 ENT will enter program number 20, Station Establishment.

Long Press

With a long press on the PRG-key you step to the program menu. Here you can display all the available programs. Any program that are available but not installed in your CU is displayed with two brackets,( ).

<-Current library and program no
<-Instrument model and program ver
<-Current program name
<-Key functions

Key functions:

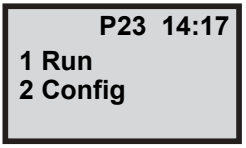
Dir:	Step between the U.D.S- and PRG-library
← →	Step backward/forward in chosen library.
Exit/MNU:	Exit without starting any program
ENT:	Start the chosen program

Note – *If the arrowkey is held depressed you will automatically step to the next/previous program without having to press the key repeatedly.*

User Defined Storage of Control Data in the Field Calculation Programs

It is possible to define what results to be stored in the JOB file using the field calculation programs. In some programs you can only add information and in some you can define data all by yourself.

See page 1-7 for a complete list of the programs that can be Configurated. When you start any of these programs by the program library you will get the following display appearance:



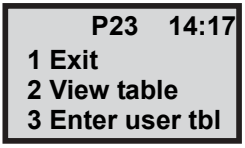
<-Current program no and time
<-Start program without any config.
<-Configure program

Note – *When pressing the PRG-key on the control unit in local mode you can only access this menu.*

Choose 1 Run to start the program without any configuration or press 2 to configure the program. Press the CL-key to exit from this menu and step to the current program.

Configurate the user defined output table

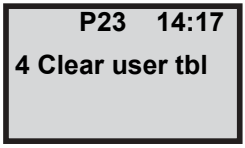
When you press 2 you will get the following display appearance:



<-Current program no and time
<-Step to the previous menu
<-View the current output table
<-Configure table

Note – *When pressing the PRG-key on the control unit in local mode you can only access this menu.*

Choose one of the alternatives (press ENT for more) or press 1 or the CL-key to step to the previous menu.

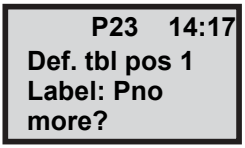


<-Clear the current user table

How to use

2 View table

If you press 2 you will view the current output table:

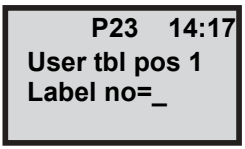


<-Current program no and time
<-Table position
<-Lable
<-View more?

This is position 1 in the output table. Press YES or ENT to view the next position or step to the previous menu with NO. When all positions in the output table are viewed you will return to the previous menu.

3 Enter user table

If you press 3 you will enter the output table:

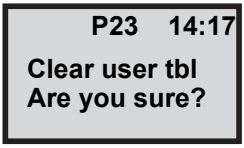


<-Current program no and time
<-Table position
<-Lable

This position 1 in the output table. Enter the first label no and press ENT. Press only ENT when you are finished. The new output table will be default.

4 Clear user table

If you press 4 you will get the following display appearance:



Press YES or ENT to delete the current output table or press NO to cancel.

Note – *When you delete the output table the standard output table will be default.*

Which data can be stored in a specific program?

On the next page is a list over the labels that are always stored in a specific program (Always) and which labels that the operator can choose whether to include or not (Standard). E.g. in program P24, RefLine, the Reference point data (labels 5, 37, 38…) are always stored. The operator can by configurating the program via the configuration menu at startup choose whether to include any of the standard labels or not, e.g. measured point data (5, 6, 37…). As default when no configuration has been made, all standard will be stored.

Program Configuration List

SetOut - P23	Always=cannot be changed Standard=can be changed
Always:	None
Standard:	5, 40, 41, 42*
RefLine - P24 **(Measure)**	
Always:	(5, 37, 38, 39, 5, 37, 38, 39, 44)¤
Standard:	5, 6*, 37, 38, 39*, 72, 73, 42*
(SetOut with Radofs/RTofs)	
Always:	(5, 37, 38, 39, 5, 37, 38, 39)¤
Standard:	5, 72, 73, 42*
(SetOut with coordinates)	
Always:	(5, 37, 38, 39, 5, 37, 38, 39)¤
Standard:	Same as P23, modified by config P23.
DistOb - P26	
Always:	5, 5, 7, 11, 10, 14None
Standard:	
Obstructed Point - P28	
Always:	20, distBC, Pno, 37, 38, 39, 7, 11, 10, 14
Standard:	Data for point A and B
RoadLine - P29 **(SetOut)**	
Always:	None
Standard:	80, 83, 40, 41, 42*, 39*
(Measure)	
Always:	None
Standard:	80, 83, 4, 37, 38, 39*

RoadLine - P39	
(SetOut)	
Always:	None
Standard:	80, 83, 40, 41, 42*, 39*
(Measure)	
Always:	None
Standard:	80, 83, 4, 37, 38, 39*

*These labels (height) are only stored if height measurement has been included in the station establishment.

¤These labels are only stored if using a known reference line.

CHAPTER

2

Edit & View

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In General

With EDIT installed in your Geodimeter CU, it is possible to carry out editing of the data within the recording device, External memory or Geodat, directly from the keyboard of the Geodimeter CU. Viewing of the data, before editing, can be done with the help of VIEW, which is automatically included in EDIT software additional option.

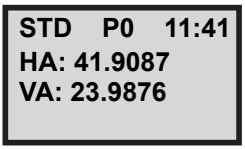
You can step through files, search for, delete, insert and change data. EDIT is selected directly from the main menu of the instrument, option 2 - EDITOR. This option is directly linked to a sub-menu which allows you to edit data in either the external memory (Geodat) or the internal memory. The editing features of this software option are menu driven with the command options shown on the bottom line of the display, which are in turn directly placed above the relevant operating key of the small keyboard. The various operations are selected by pressing the relevant key. The keyboard is reconfigured to the actual chosen mode and when the bottom line is not visible, the key continues to operate with its original function.

How to use

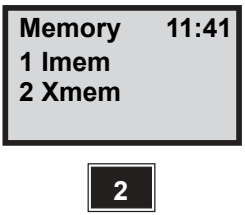
The program consists of three modes of operation, each with its own menu. The modes are 1 View, 2 Edit and 3 Directory. To enter the editor, follow the instructions below.

Startup

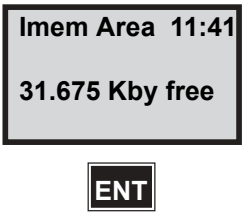
Enter the program via menu 2.



In which memory unit do you want to work, 1 the internal memory or 2 an external memory.

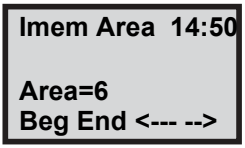


You are now displayed the remaining memory capacity (total number of Kbytes free). Press ENT to step further.



View

In this mode you can select which file you want to view. Her you can also view the functions to step forward or backwards in the file.



<- Current memory unit and file type

<- Current file number

<- Command line

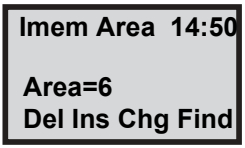
Beg	Jump to the beginning of the file.
End	Jump to the end of the file.
<-	Step to the previous line in the file.
->	Step to the next line in the file.

Note – *arrowkeys*
If the arrowkey is held depressed you will automatically step to the next/previous line without having to press the key repeatedly.

ENT	Press this key to step to the next mode=EDIT
MNU	Press this key to return to the main menu.

Edit

In this mode you can find, change, insert and delete data in the file you have chosen.



<- Current memory unit and file type

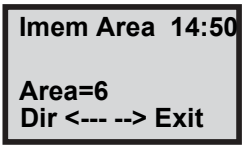
<- Current file number

<- Command line

Del	Delete current label and prompt or complete file. Deletion of complete files can be executed when the prompt is a filename e.g. Job No. To avoid accidental file delection a “yes/no” prompt must be answered.
Ins	Insert a label and prompt in front of the one displayed.
Chg	Change data relating to displayed label.
Find	Search for label and label and prompt. When the data value for a prompt is keyed in, the first prompt with that value is displayed.
ENT	Press this key to go to the next mode= DIRECTORY
MNU	Press this key to return to the main menu

Directory

In this mode you can select what type of file you want to view, Area- or Job-file.



<- Current memory unit and file type

<- Current file number

<- Command line

Dir: Switch between the Job and the Area file directory

<-: Show the name of the file following the one now displayed

->: Show the name of the file in front of the one now displayed

Exit: Exit to the main menu

Note – *arrowkeys*
If the arrowkey is held depressed you will automatically increase/decrease the file number without having to press the key repeatedly.

Press this key to go to the next mode=VIEW. If the current file is not visible in the display a prompt for change to file? is seen. In the case of answering YES the old file is closed and the new is opened. Answering NO will lead you back to VIEW without file change.

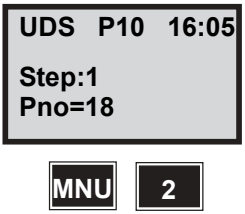
Press this key to return to the main menu.

Examples

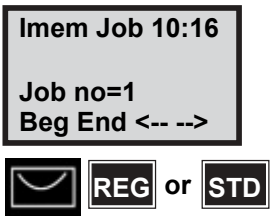
In order to fully appreciate the operating flexibility of EDIT, we will now run through a few examples. It is assumed that before you start the editing examples you should prepare the instrument as follows: Set up the instrument and survey in a few points using one of your own specially designed UDS´s and store them.

Change Data/Replace With new Data

After registration of a point you realise that the last SH of 0.8m for Pno 17 was wrong. First follow the startup instruction described on page 4.2.3. In this example we choose the external memory.

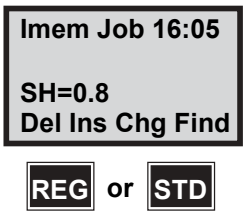


As you know that it was the last point you first press End to go to the end of the Jobfile. Then you can use the >-=(REG-numeric keyboard or STD-alphanumeric) to step back to the wrong SH.

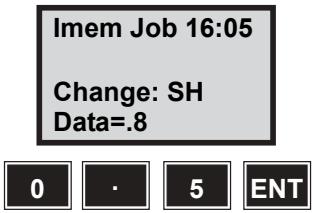


Now press the ENT key to step to the EDIT mode.

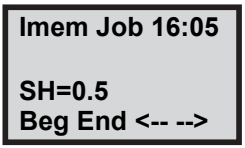
You are now in EDIT mode and you want to change the SH value from 0.8m to 0.5m. Press therefore the CHG key=(REG-numeric keyboard or STD-alphanumeric).



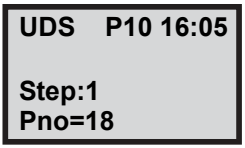
Key in 0.5 to overwrite the wrongly stored value of 0.8 and accept with ENT. Press only ENT if no change is to be made.



In order to see that the changed SH value has been stored in the correct place use the arrowkeys.

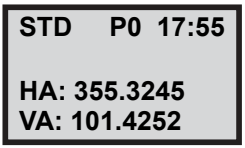


Press MNU twice to return to the UDS-sequence.



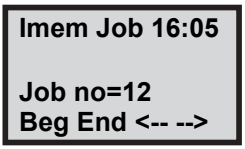
Find and Change Data

Follow the startup instruction described on page 2-3. In this example we choose the internal memory.



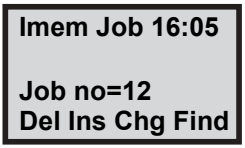
MNU 2

You are now in the VIEW mode. Press ENT to go to the EDIT mode.



ENT

You wish to find the point No 204 to change its SH to the correct value 1.7. Press the FIND key=(A/M-numeric keyboard, TRK-alphanumeric).



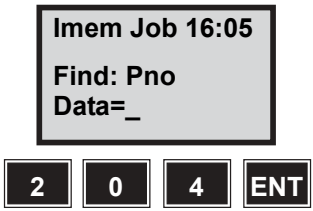
A/M or TRK

Note – *Find If wishing to find data try always to be at the front (top) or back (end) of the data file before the search begins. If you go past a value and try to find it, an error will be given, i.e. INFO 32.*

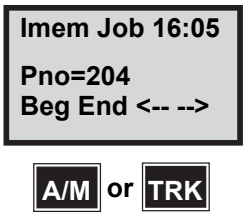
If wishing to find data which belongs to one particular label, the find routine will jump consecutively through the file from that particular label No. to the next one, jumping the other labels in between.

In order to first find the point No you first have to choose the label No for Pno. Key in 5 and ENT.

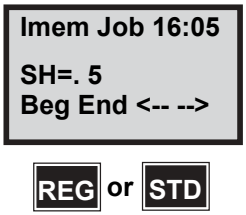
Here the Pno is being asked for. Key in 204 and ENT.



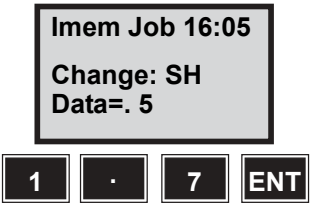
You know that in the UDS you are using SH lies 2 steps after Pno 204. Press the --> key (A/M-numeric keyboard, TRK-alphanumeric) twice or keep it depressed until SH is found.



In order to change the SH from.5 to 1.7 press the CHG-key=(REG-numeric keyboard, STD-alphanumeric).

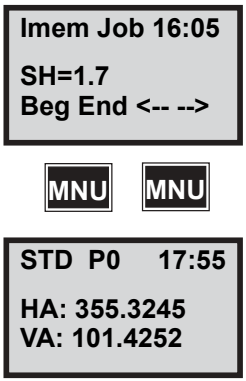


Overwrite the displayed data. Key in 1.7 and press ENT.



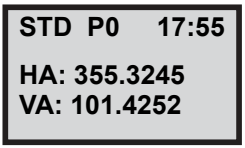
The correct SH is now stored in the memory device.

Press MNU twice to return to the theodolite mode.



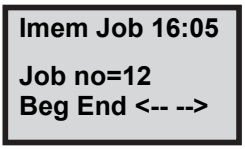
Delete/Insert

Follow the startup instruction described on page 2-3. In this example we choose the internal memory.



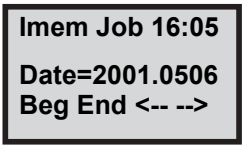
MNU 2

Your general data lies at the beginning of your Job data file, so you need only come to DATE=2001.0506



A/M or TRK

You wish to delete this completely and replace it with time. Press ENT to step to the EDIT mode.



ENT

Now delete Date by pressing DEL.

```
Imem Job 16:05

Date=2001.0506
Del Ins Chg Find
```

Your next prompt is now displayed. Return to the EDIT mode by pressing ENT.

```
Imem Job 16:05

Stn=101
Beg End <-- -->
```

ENT

Now insert in front of Stn=101. Press INS.

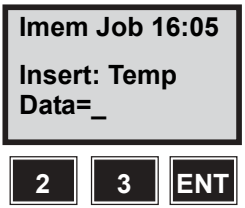
```
Imem Job 16:05

Stn=101
Del Ins Chg Find
```

You shall insert temp. first. Label No. for temp. is 52. Key in 52 and ENT.

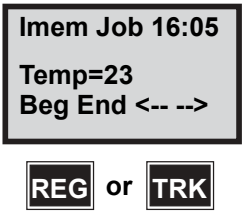
```
Imem Job 16:05

Insert
Label=_
```

5 **2** **ENT**

The temp. which you wish to record was the temp. at the time of the actual measurements. Key in 23 and ENT:

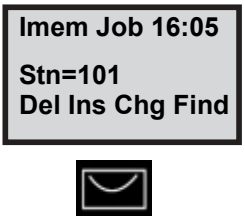


To check that the inserted temp. data has been inserted into the correct place press the arrow keys.



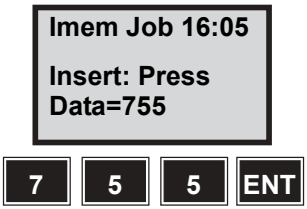
Make sure you have Stn=101 in display before inserting the pressure label. Then press ENT to step to the EDIT mode.

Now choose the Ins function to insert the missing pressure data. Press Ins.



The label No. for pressure is 74. Key in 74 and press ENT.

The pressure at the time of the measurements was 755 mmHg. Key in 755 and press ENT.



Temp. and Pressure values are now stored in the memory device before Stn.name in the Job no file. Use the

arrowkeys to check the position of the prompts and their values.

```
Imem Job 16:05

Press=755
Beg End <-- -->
```

Change From one File to Another

Follow the startup instruction described on page 2-3. In this example we choose the external memory. Then enter the DIRECTORY mode.

Here you can page through your Job/Area files. At the moment you are in the Job file directory. Press <- or -> to page through your list of stored Job files.

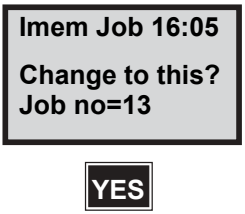
```
Imem Job 16:05

Job no=12
Dir <-- --> Exit
```

When you come to the next Job No file you are looking for, press ENT.

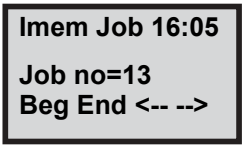
```
Imem Job 16:05

Job no=13
Beg End <-- -->
```

ENT

Is this the file to which you want to change? Answer YES or NO to confirm. Press YES.



You are now in the VIEW mode at the top (beginning) of Job file No. 13. Press ENT if you want to EDIT or use the arrowkeys to view the file.



The above example can of course be done with Area files if you had pressed the Area option in the first display shown on this page.

Clear Memory

Follow the startup instruction described on page 2-3. In this example we choose the external memory. Then enter the EDIT mode.

In order to delete Job no 13 from the memory press DEL.

```
Imem Job 16:05

Job no=13
Del Ins Chg Find
```

Here you have a chance to change your mind about total erasure of the file. Press YES or NO.

```
Imem Job 16:05

Are you sure?
```

YES

Job no 13 is now deleted from the memory.

```
Imem Job 16:05

Job no=0
Beg End <-- -->
```

View

View enables you to retrieve and check data stored in either the external memory (card memory) and/or the internal memory of Geodimeter CU. Checking of data is limited to the Job No. file in which you are presently working. To view Job files other than the one in which you are presently working, see Directory, page 2-6.

The program consists of two modes of operation, 1 View and 2 Directory, which are described on page 2-6 and page 2-6 To step between the two modes use the ENT-key. To start the program follow the startup instruction on page 2-3

CHAPTER

3

P20 Station Establishment

In General 3-2

How to use 3-7

- Known Station 3-7
- Known Station+ 3-15
- Free Station 3-31
- Eccentric Station 3-54

In General

Station Establishment (P20) is a basic software package for Geodimeter CU field calculation programs. This program is used to calculate and store instrument setup data which is required for some of the field calc.programs. The programs that follow P20 are SetOut, RoadLine and RefLine (see figure 3.1). If you try to activate any of these programs without first establishing your station, you are taken directly to P20.

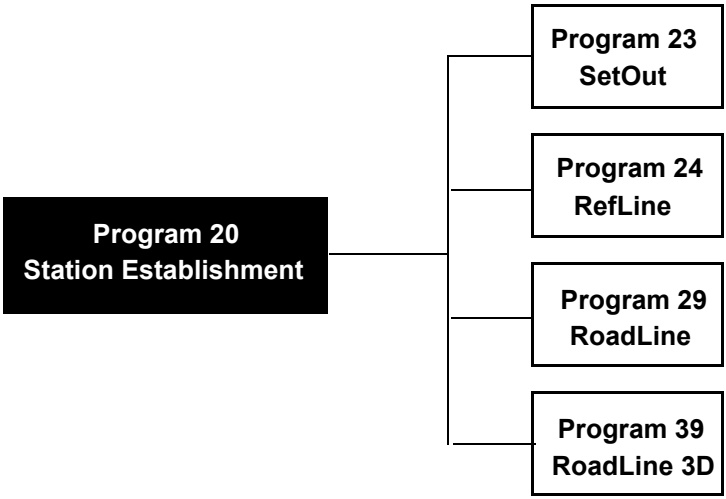


Figure 3.1 Station establishment is necessary for running the above programs.

The program is divided into three main functions:

1 Known station for station establishment when the coordinates of your station point and reference object are known.

2 Free station	for free station establishment using 2-8 points whose coordinates are known.
3 Known station+	for station establishment when the coordinates of your station point and up to ten reference objects are known.

Preparations

Before station establishment can take place, the coordinates and point numbers must be stored in an Area file – either in the internal memory or in an external memory such as Card memory or – using P43 (Enter Coordinates) or downloaded from a computer. These coordinates are then used in P20 when you retrieve the correct Area file and Pno.

Known Station & Known Station+

When establishing a station at a known point, you will only need the point numbers for your station point and reference object. The instrument will then calculate bearing and distance automatically. To increase the accuracy of the bearing a new routine called “Known Station+” has been implemented in the instrument. By using this function you can measure to up to ten reference objects and also obtain a standard deviation (S_dev). See more about this routine on page 3-15. When running Known Station in P20, you decide whether or not elevations are to be used in other calculation programs. Here you also indicate in what Job file station data and possibly other data to be calculated later will be stored, and in what Area file the coordinates are stored. See on page 3-29 what is stored in the selected Job file when a Known Station has been established.

Free station

You choose free station establishment when the station point is unknown – that is, N, E and possibly ELE will have to be calculated. This function allows free establishment in which several different combinations of objects, angles and distances can be used. The calculation is a combination of resection and triangulation. If you make several measurements, you obtain not only the mean value but also the standard deviation (S_dev). The calculation is done according to the least square adjustment method. If good results are to be obtained using this method, it is important that the traverses and networks are of high quality. For this reason we have provided the Free Station routine with a function called Config. (configuration). This allows you to use factors such as the scale factor (stored under label = 43), weight factors to weight your points with regard to the distance from your free station to the known point (used mainly in Germany), and also to create a point list in which all measured data for each individual measured point can be made available for editing and possible recalculation. In the example on page 3-31 we have chosen not to use Config. but to treat it separately on page 3-50.

Free station establishment can be done with a large number of different combinations of points, angles, and distances (see figure 3.2)

Free station establishment using 3-10 known points, the following combinations are possible:

1. Angles distances
2. Only angles. But note that three points alone will not provide enough data to be able to calculate an optimal solution – that is, they will not give a standard deviation.

Note – *If only 3 angles are used, try to establish within the "triangle" in order to avoid the "dangerous circle".*

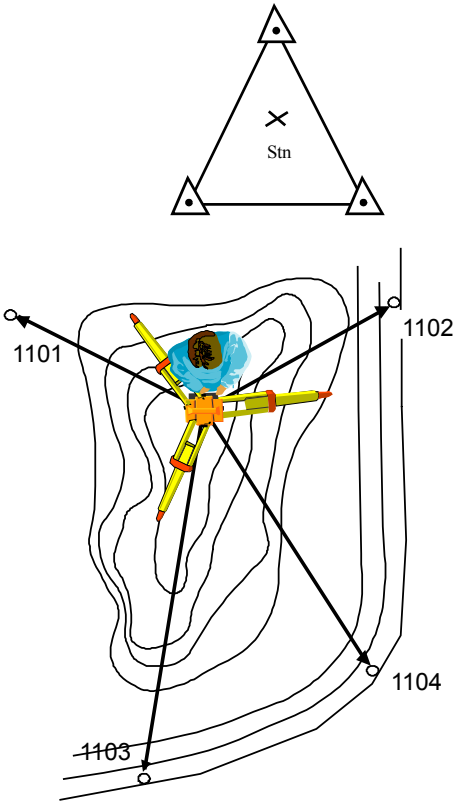


Figure 3.2 Free station establishment

In free station establishment with two known points, the following is valid:

1. Angles and distances.

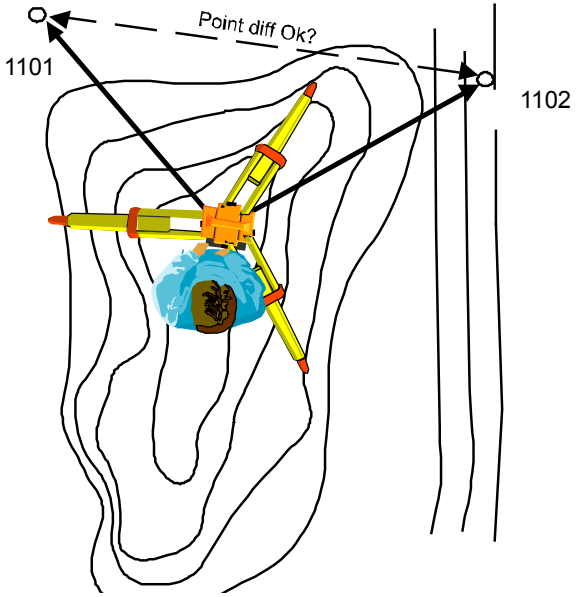


Figure 3.3 Free station establishment with 2 known points

Eccentric Station

With Eccentric station distance and angles will be measured to one point and to the second point only angles will be measured (like a church tower).

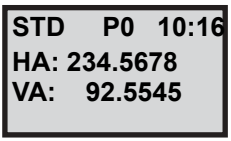
1. Always measure the points clockwise.
2. Only two points can be used.
3. The HA difference must be less than 200 grads (180°).
4. A distance can only be measured towards one of the objects.

How to use

The examples that follow deal with three kinds of station establishment: Known Station, Known Station+ and Free Station. It is assumed that you are familiar with the operation of your Trimble instrument. Switch on the instrument and go step by step through program 0 until you are in theodolite position – that is, HA and VA are shown on the display.

Known Station

The instrument is now in theodolite position. Select P20 (Station Establishment).



PRG | 2 | 0 | ENT

In this first example we will establish a station with a known point and reference object. These are stored as Pno and coordinates in an Area file, using P43 (Enter Coordinates). Pno 1101 is our station point and Pno 1102 is our reference object.
Now we will select option 1, Known Station.

1

Note – *An example of free station establishment is found on pagepage 3-31*

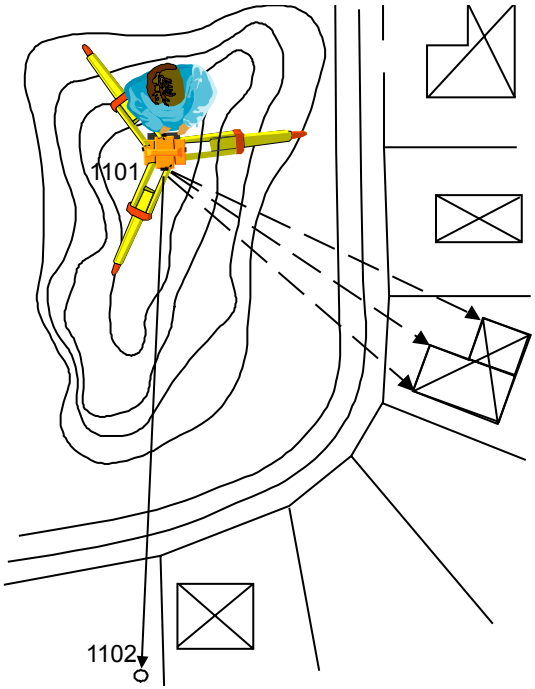
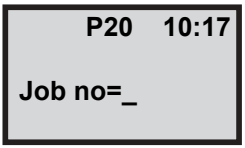


Figure 3.4 Station establishment with a known station and one reference object

Here you key in the number or name of the Job file in which you wish to store data from your station establishment. A

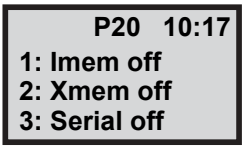
list of data stored in the selected Job file can be seen on page 3-29. Select, for example, Job no = 2.



2 ENT

Note – *Displayed if Job/Mem is switched on (MNU61)*

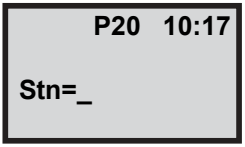
Where will you store your Job file? Choose a suitable memory unit by indicating 1, 2 or 3 for activation/deactivation. Then press ENT. Here we have chosen to work with the internal memory.



1 ENT

Note – *Only displayed if Job/Mem is switched on (MNU61)*

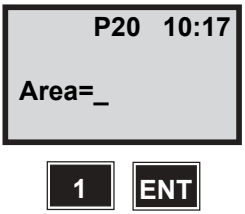
Key in your station number.



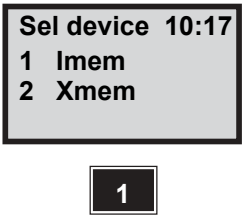
1 1 0 1 ENT

Key in the name of the Area file in which you have stored your station point and your reference object. If you leave

the line blank you are able to enter the coordinates manually. *See Enter the coordinates manually page 3-10.*



In which memory unit is the Area file stored? In this example we are using the internal memory (Imen).

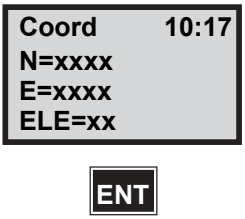


Note – *See note on page 3-33.*

Enter the coordinates manually

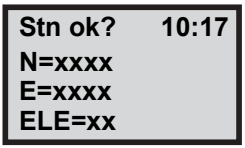
Continue from page page 3-9.

Enter your station coordinates. Leave the ELE blank for no height establishment. (*This display will only appear if you have left the Area file line blank*.)



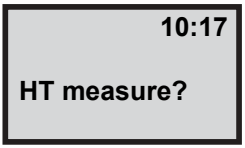
Are your coordinates correct? Press Yes (ENT) to accept them. If you press NO you will return to the question about

STN = and Area=. If the coordinates have to be changed, use Edit or P43 (Enter Coordinates). In this example we will continue by accepting them.



Note – *Only displayed if Confirmed is switched on (MNU 61)*

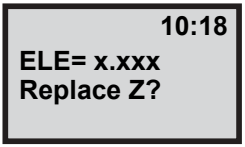
Are you going to measure heights? Accept this question by pressing ENT (Yes). If you decide not to measure heights (press No) it means that the instrument height (IH) and signal height (SH) will be ignored. In this example, we will be measuring heights. Press ENT.



Note – *Only if your coordinates includes ELE*

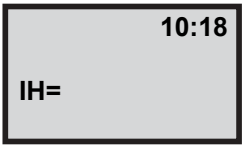
This is your old station ground elevation. Press ENT (Yes) is you want to replace the old elevation With the new or press NO to cancel it. In this example we press ENT.

(This display will only appear if the ground elevation has already been determined).



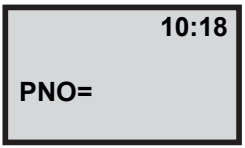
Note – *Only if your coordinates includes ELE*

Enter your instrument height (IH). For example, 1.75.

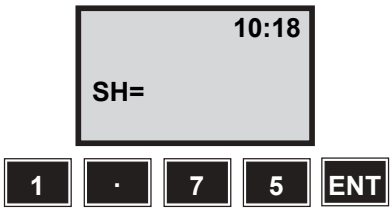


Note – *Only if your coordinates includes ELE*

Key in the Pno of your reference object. For example, 1102.

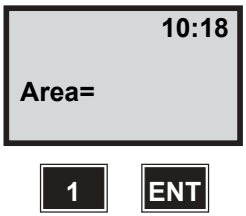


Enter your signal height (SH). For example, 1.75.

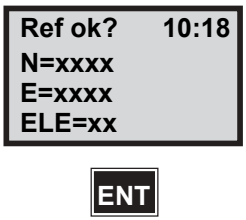


Note – *Only if your coordinates includes ELE*

Key in the name of the Area file in witch you have stored your reference object. If you leave the line blank you will have the opportunity to enter the coordinates manually in the same way as for the station coordinates.

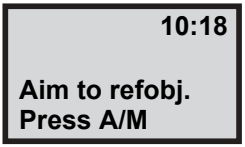


Are your coordinates correct? Press ENT to accept them. If you press NO you return to the question Refobj=. If they have to be changed, use Edit or P43 (Enter Coordinates). We will continue by accepting them.

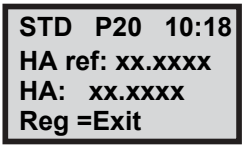


Note – *Only displayed if Confirmed is switched on (MNU 61)*

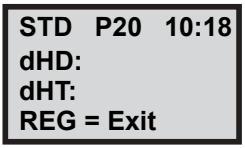
Aim at your reference object. Then press the A/M key.



HAref is the calculated bearing between the station point and the reference pint. If you wish to check the distance to the reference object, press ENT. Otherwise press REG to store the station establishment.



If the reference object is marked with a reflector, you can also check the horizontal distance by pressing the A/M key. Otherwise press REG to store the station establishment.



Note – *dHT is only shown if height measurement should be determined.*

Here you can compare the calculated distance with the actual measured distance. Press REG to store station

establishment in the Job file you have chosen (see page page 3-29).

```
STD   P20   10:19
dHD:       xxx.xxx
dHT:       xxx.xxx
Reg =Exit
```

REG

Note – *The REG key must always be used if you want to store the station establishment.*

Known Station+

The instrument is now in theodolite position. Select P20 (Station Establishment).

```
STD   P0   10:17
HA: 234.5678
VA: 92.5545
```

PRG 2 0 ENT

In this first example we will establish a station with a known point and reference objects. These are stored as Pno and coordinates in an Area file, using P43 (Enter Coordinates.). Pno 1101 is our station point and Pno 1102, 1103 and 1104

are our reference objects, as in the example on page page 3-16. Now we will select function 3, Known Station+.

```
Stn.estab   10:16
1.Known Station
2.Free Station
3.Known Station+
```

3

Note – *An example of free station establishment is found on page 3-31.*

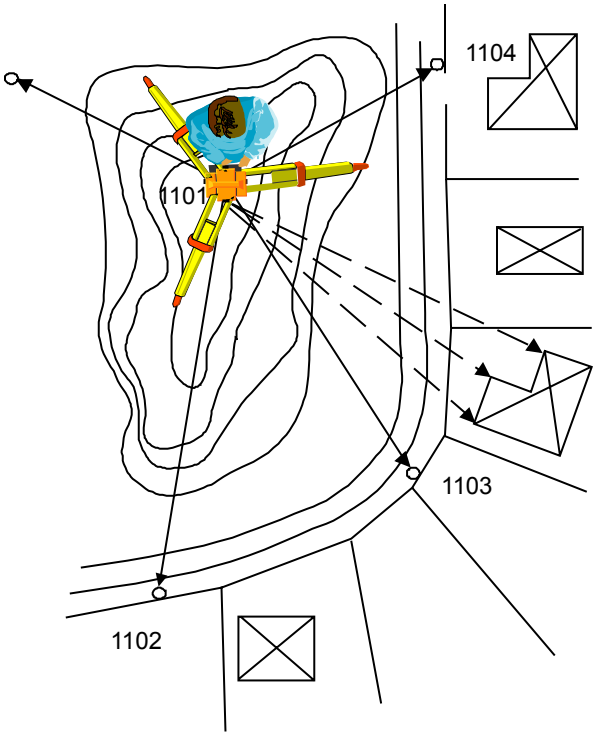
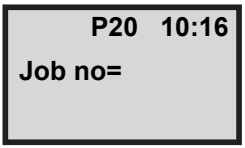


Figure 3.5 Station establishment with a known station and 1-10 reference objects

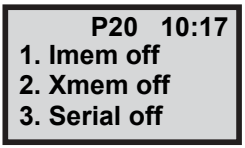
Here you key in the number or name of the Job file in which you wish to store data from your station establishment. A list of data stored in the selected job file can be seen on page page 3-29. Select, for example, Job no = 2.



2 ENT

Note – *Displayed if Job/Mem is switched on (MNU61)*

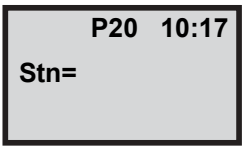
Where will you store your Job file? Choose a suitable memory unit by indication 1, 2 or 3 activation/deactivation. Then press ENT. Here we have chosen to work with the internal memory.



1 ENT

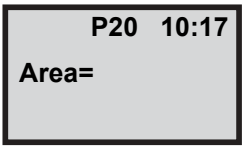
Note – *Only displayed if Job/Mem is switched on (MNU61)*

Key in your station number.



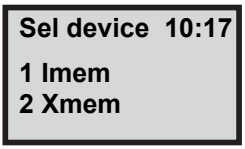
1 1 0 1 ENT

Key in the name of the Area file in which you have stored your station point and your reference object. If you leave the line blank you are able to enter the coordinates manually. *See Enter the coordinates manually page 3-18*.



1 **ENT**

In which memory unit is your Area file stored? In our example, we are using the internal memory (Imem).

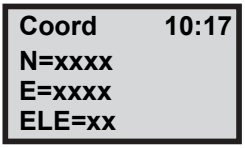


1

Enter the coordinates manually

Continue from page 3-18.

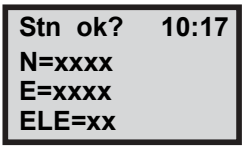
Enter your station coordinates. Leave the ELE blank for no height establishment.



ENT

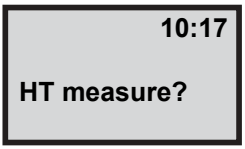
Are your coordinates correct? Press Yes (ENT) to accept them. If you press No you will return to the question about

Stn= and Area=. If the coordinates have to be changed, use Edit or P43 (Enter Coordinates). In this example we will continue by accepting them.



YES

Are you going to measure heights? Accept this question by pressing ENT (Yes). If you decide not to measure heights (press No) it means that the instrument height (IH) and signal height (SH) will be ignored. In this example, we will be measuring heights. Press YES.



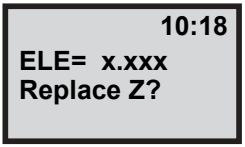
YES

Note – *Only shown if your coordinates includes ELE.*

This is your old station ground elevation.

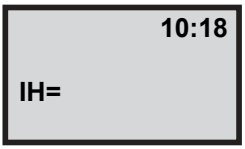
Press YES (ENT) if you want to replace the old elevation with the new or press NO to cancel it. In this example we press YES.

(This display will only appear if the ground elevation has already been determined).



YES

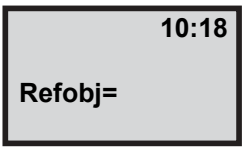
Enter your instrument height (IH). For example, 1.75.



1 · 7 5 ENT

Note – *Only shown if your coordinates includes ELE.*

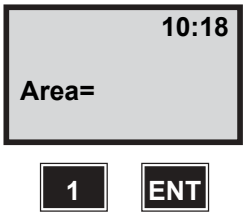
Key in the Pno of your reference object. For example, 1102.



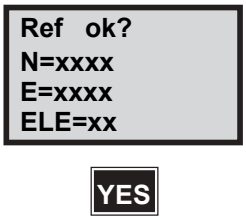
1 1 0 2 ENT

Key in the name of the Area file in which you have stored your reference object. If you leave the line blank you will

have the opportunity to enter the coordinates manually in the same way as for the station coordinates.

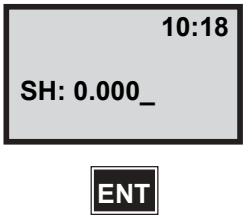


Are your coordinates correct? Press YES to accept them. If you press No you return to the question Refobj=. If they have to be changed, use Edit or P43 (Enter Coordinates). We will continue by accepting them.

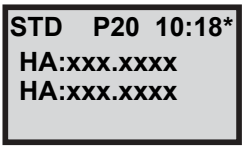


Note – *Only displayed if Confirmed is switched on (MNU 61)*

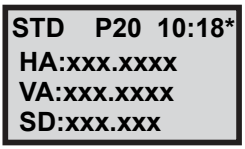
Enter the signal height (SH) and press ENT



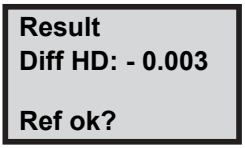
The instrument is now in theodolite position and is ready to measure. Aim at the chosen target. Press the A/M key if distance is to be measured, otherwise REG. *See next step.*



The instrument displays HA, VA and SD for your first point. Your measurement can now be registered. Press the REG key.

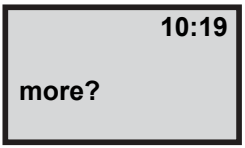


Here the difference between measured and theoretical horizontal distance (HD) is shown. Press YES to accept or NO to redo the measurement or select another reference point.



Note – *Diff HD is shown only if distance has been measured.*

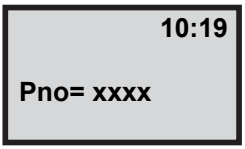
Are you going to use more points for your station establishment, or are you satisfied with only one? In our example we will measure and register two more points (maximum number = 10). Press YES.



YES

Enter the next Pno to be used for your known station (the display here shows the most recently used Pno).

Then press ENT.



ENT

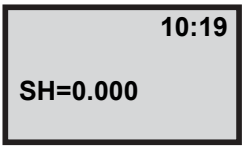
Note – *The points selected for your station establishment can be measured in any order.*

Are your coordinates correct? Press YES or NO. If they have to be changed, use Edit or P43 (Enter Coordinates). In this case, we'll answer YES.

YES

Note – *Only displayed if Confirmed is switched on (MNU 61)*

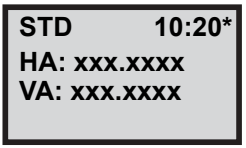
Enter the signal height (SH). In this case 1 and press ENT.



1 **ENT**

Note – *Only shown if your coordinates include ELE.*

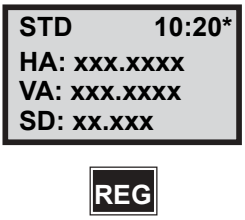
Aim towards your target, then press the A/M key to measure.



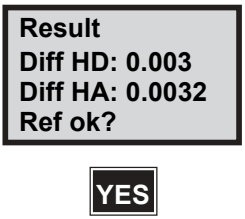
A/M

Note – *If you are using a servo instrument press the* *key to position to point 2-10. Fine adjust manually. See next step.*

The instrument has now measured angles and distance to the second point of your known station establishment. Press REG to register your measured data.



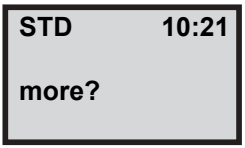
Diff HD is the difference between measured and theoretical horizontal distance to the second point. Diff HA is the difference between theoretical and measured angle between point 1 and 2. Press YES to accept or NO to redo the measurement.



Note – *If more than 2 points have been measured, Diff HA will be replaced by S_dev HA, i.e the standard deviation of the horizontal angles.*

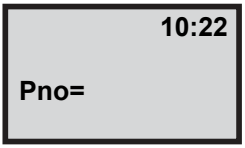
Are you going to use more points for your station establishment, or are you satisfied with two? In our

example we will measure and register one more point (maximum number = 10). Press Yes.



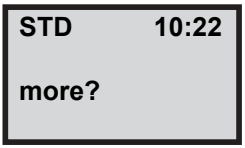
Key in the third point to be used, and repeat the procedure described above. In this example, we have measured and stored a total of three points whose coordinates are known for our known station.

Assuming that these have been measured and registered, let us continue directly to the question ”more?” after storing the last point.

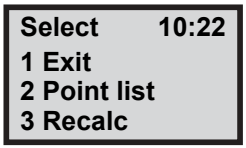


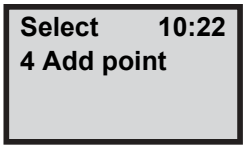
Note – *If you are using a servo instrument press the* *key to position to point 2-10. Fine adjust manually.*

All points to be used for our known station establishment are now stored. Answer ”more?” with NO. The program immediately calculates your station coordinates.

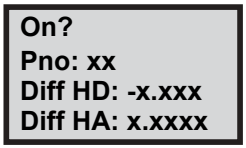


Now you're taken to the Select menu. Here you can choose to either exit P20, edit the point list, recalculate the point data or add more points. (You can switch between the two pages by pressing the ENT button). In this example we choose to edit the point list. Press 2. *See next step.*



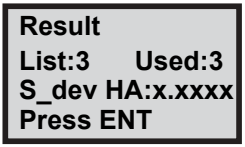


Here you can choose which points you want to use in the point list. Choose On, Off or Delete by pressing the NO button, then accept with ENT.



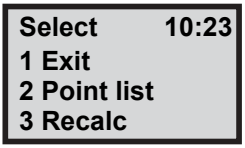
When you have chosen your points for the point list and accepted with ENT, calculation automatically starts and the result is shown in the display.

Press ENT to exit to the Select menu.

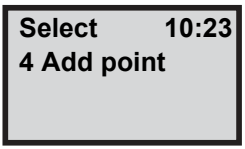


Now you're taken back to the Select menu. Here you can choose to either exit P20, edit the point list once again, recalculate the point data (i.e se the result once again) or add more points.

(Switch between the pages with ENT).



Press 4 if you want to add points to improve the result. In this example we're satisfied with the result. Press 1 to exit P20.



Note – *That the current instrument direction is stored as HA_ref.*

Job File (1 ref point)		Job File (2-10 ref points)	
Job File		Stn	2
Stn	2	Stn Coordinates	37, 38, (39)
Stn Coordinates	37, 38, (39)	RefObj	5
RefObj	62	SH	6
RefObj Coords	37, 38, (39)	RefObj Coords	37, 38, (39)
HA_ref *	21	Raw data	7, 8, (9)
HD	11	Weight =/1 if OFF	0
IH	3	Info: Diff HA or S_dev HA	0
		Info: Point list	0
		RefObj	5
		Delta HD (if available)	76
		Delta HA	45
		Stn	2
		Stn Coordinates	37, 38, (39)
		RefObj=Blank	62
		RefObj Coords=0.000	37, 38, (39)
		HA_ref *	21
		HD=0	11
		IH	3

Here are the data that can be stored in the Job file you have chosen.

* HA_ref for Known Station = calculated and Set HA,

HA_ref for Known Station+ = Current instrument direction when exiting P20.

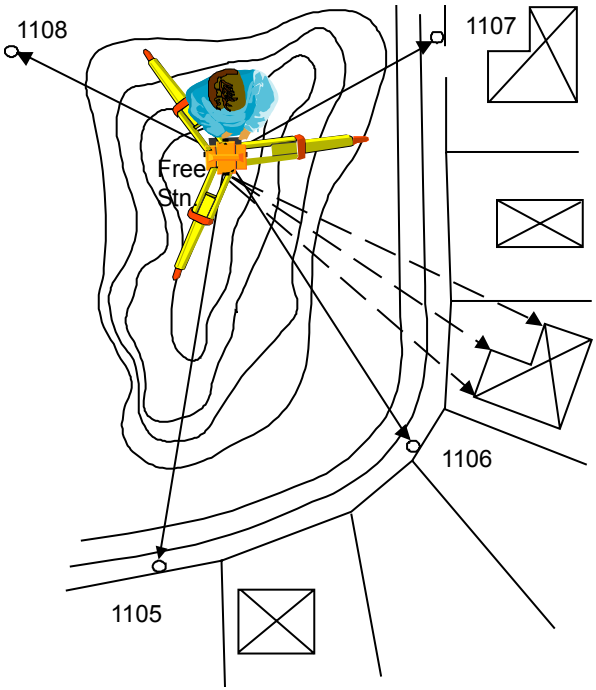


Figure 3.6 Free station establishment

Free Station

Select Program 20.

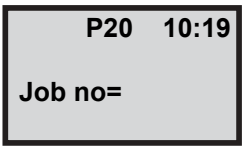
PRG 2 0 ENT

In this example, we will establish a free station. The known points we will be using have been stored as Pno and coordinates in an Area file using P43 (Enter Coordinates).

We will choose function 2, Free Station.

2

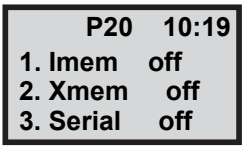
Here you key in the number or name of the Job file in which you wish to store data from your station establishment. A list of data stored in the selected Job file can be seen on page 3-46 and page 3-49. Select, for example, Job no = 20.



2 0 ENT

Note – *Only displayed if Job/Mem is switched on (MNU61)*

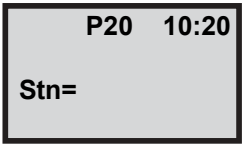
Where will you store your Job file? Choose a suitable memory unit by indicating 1, 2 or 3 for activation/deactivation. Then press ENT.



1 **ENT**

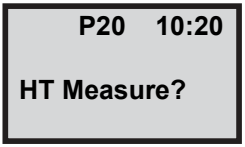
Note – *Only displayed if Job/Mem is switched on (MNU61)*

Here you enter a name/number for your free station.



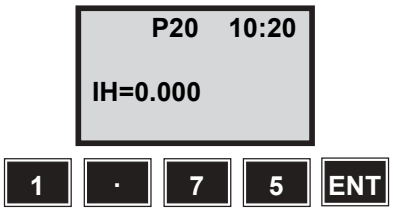
ENT

Are you going to measure heights? Accept this question by pressing YES (ENT). If you decide not to measure heights (press No) it means that the instrument height (IH) and signal height (SH) will be ignored. In this example, we will be measuring heights. Press YES.



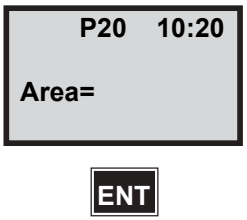
YES

Enter your instrument height (IH). For example 1.75

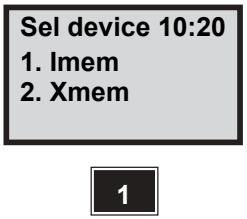


Note – *Only shown if height should be determined*

Key in the name of the Area file in which you have stored your known Pno and coordinates. Then press ENT.



In which memory unit is your Area file stored? In our example, we are using the internal memory (Imem).



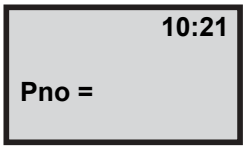
Note – *If you get Info 32 when selecting a memory unit, it may be due to one of the following:*

1. You have chosen the wrong memory unit.
2. The Area file you are looking for is not located in the memory you have selected.

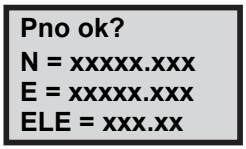
3. The Stn (Pno) which you are looking for is not stored in the Area file you have selected.

   The program will then return to the question ”Area =" so that you can enter another Area file number or point number.

Enter the number of the first point you want to aim at. Then press ENT.



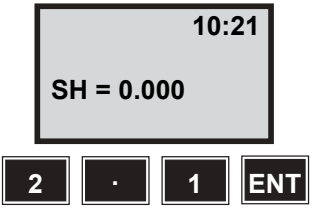
Are your coordinates correct? Press YES (ENT) to accept them. If they have to be changed, use Edit or P43 (Enter Coordinates). In this example we will continue by accepting them.



Note – *Only displayed if Confirmed is switched on (MNU 61)*

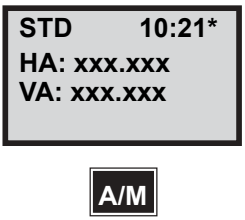
Enter the signal height (SH).

For example 2.1 and press ENT.



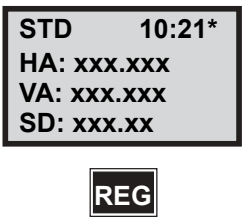
Note – *Only shown if height should be determined*

The instrument is now in theodolite position and is ready to measure. Aim at the chosen target. Press the A/M key if distance is to be measured, otherwise REG.

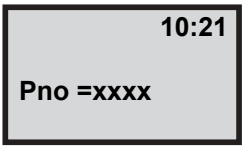


Note – *Distance measurement must be carried out when measuring heights.*

The instrument displays HA, VA and SD for your first point. Your measurement can now be registered. Press the REG key.



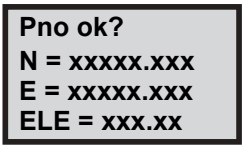
Enter the next Pno to be used for your free station (the display here shows the most recently used Pno). Then press ENT.



ENT

Note – *The points selected for your station establishment can be measured in any order.*

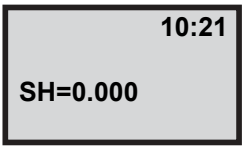
Are your coordinates correct? Press YES or NO. If they have to be changed, use Edit or P43 (Enter Coordinates). In this case, we'll answer YES.



YES

Note – *Only displayed if Confirmed is switched on (MNU 61)*

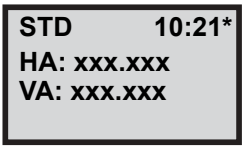
Enter the signal height (SH). In this case 3 and press ENT.



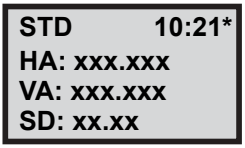
3 ENT

Note – *Only shown if your coordinates include ELE*

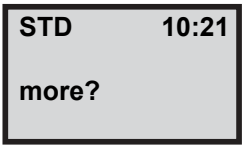
Aim at your target. Then press the A/M key to measure distance.



The instrument has now measured angles and distance to the second point of your free station establishment. Your measured data can now be registered.



Are you going to use more points for your station establishment, or are you satisfied with only two? In our example we will measure and register two more points (maximum number = 8). Press YES.

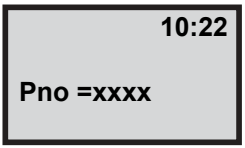


Note – *If complete measurements have been carried out — that is, angles and distances — two points will suffice. If, on the other hand, only angles have been measured, at least*

three points are needed. This is not an optimal solution, and the display warns you with the message ”Not Optimized”.

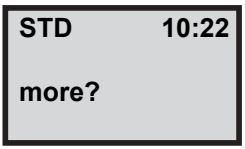
Key in the third point to be used, and repeat the procedure described above. In this example, we have measured and stored a total of four points whose coordinates are known for our free station.

Assuming that these have been measured and registered, let us continue directly to the question ”more?” after storing the last point.



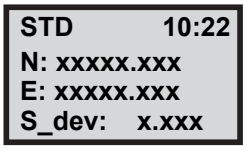
Note – *If you are using a servo instrument press the* *key to position to point 3-8. Fine adjust manually*

All points to be used for our free station establishment are now stored. Answer ”more?” with NO. The program immediately calculates your station coordinates.

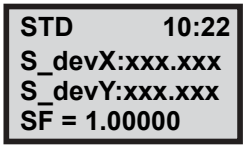


These are your new station coordinates plus any standard deviation there may be. To see the standard deviation in N

and E plus the scale factor used, switch the display by pressing the ENT key.

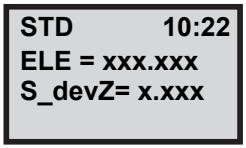


This is the standard deviation in N and E plus the scale factor used (scale factor = 1.0000 if it is off.) Press ENT.



Here is your calculated station elevation shown if you have chosen to measure heights.

Here you can also see the standard deviation based on all observations. If the standard deviation or difference in elevation (in the case of 2 points) is too large redo the measurement again without storing the actual.

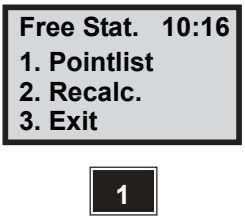


Note – *On the following pages we will describe how to use the point list. See page page 3-49 if you have deactivated the point list.*

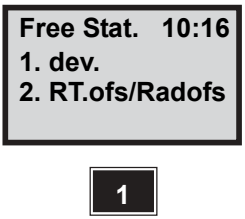
Point List

In this example we will take a closer look at the point list which is obtained after you have established your free station (here we assume that the point list has been activated under ”Config.”).

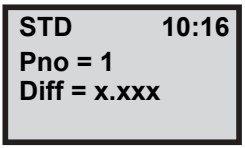
The point list allows you to look at, and deactivate, any deviations there may be for each point. The deviations are displayed as ”dev. =” (radial deviation) and ”RT.ofs/Radofs” (right offset and radial offset). We’ll select point 1.



Here you can look at 1 (dev = radial deviation). If there is a major radial deviation, you can make a more detailed analysis by selecting 2 (RT.ofs/Radofs). See Detailed analysis by selecting 2 (RT.ofs/Radofs), page 3-41.



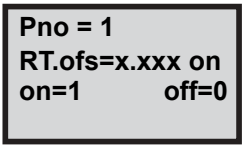
Here the radial error is displayed for point no. 1. For an explanation of "dev", see page page 3-52. By pressing ENT you can check the radial errors for all the points.



Continue: *How to use the point list (cont) on page 3-42.*

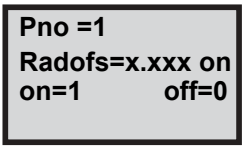
Detailed analysis by selecting 2 (RT.ofs/Radofs)

This is the difference in distance — that is, how much to the left (- value) or right (+ value) your theoretical point lies relative to your measured point (see figure 3.7, page 3-52). Select activation/deactivation and then press ENT.

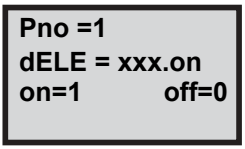


This is the difference in distance between your measured point and the theoretical point, along the line of measurement. A minus sign indicates that the measured

point lies beyond the theoretical point. A plus sign indicates that it is ahead of that point.

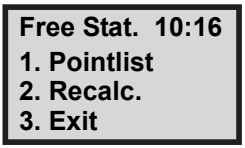


This page is shown for all points that have 2 coordinates and one measured distance. Any one of these points can be used for calculation of the station height. The displayed value is the difference between the calculated average height and the height, calculated from this point only.

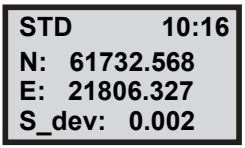


How to use the point list (cont)

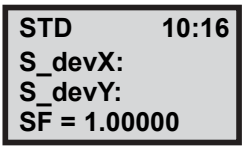
After going through the point list and possibly deactivating one or more parameters of your points, you will have to recalculate using the coordinates you want for your free station establishment. Do this by selecting function 2, Recalc.



These are your new station coordinates together with the resulting standard deviation in N and E. To see the standard deviation in N and E plus the scale factor used, switch the display by pressing the ENT key.

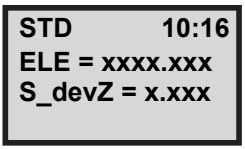


This is the standard deviation in N and E plus the scale factor that has been used (scale factor = 1.0000 if it is Off). Press ENT.



Here is your calculated station elevation shown if you have chosen to measure heights.

Here you can also see the standard deviation based on all observations. If the standard deviation or difference in elevation (in the case of 2 points) is too large redo the measurement again without storing the actual.

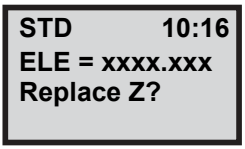


Here you select function 3, Exit.

3

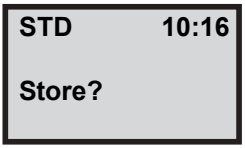
This is your old station ground elevation.

Press YES (ENT) if you want to replace the old elevation with the new or press No to cancel it. In this example we press YES. (This display will only appear if the station ground elevation has already been determined).



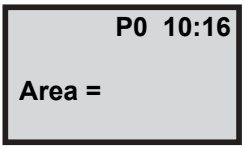
YES

Now the instrument is orientated. Do you want to store the point in an Area file answer this question with YES (ENT).



YES

Key in the name of the Area file in which you want to store the point. Then press ENT.

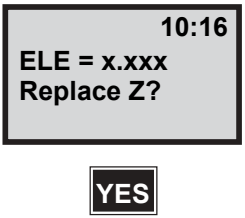


In which memory unit is your Area file to be stored? In our example we are using the internal memory (Imem).

			Pointlist ON	
	Job File		**Area File**	
	Pno	5	Pno (Stn)	5
	SH	6	N	37
	Coord	37, 38, (39)	E	38
	Raw data	7, 8, (9)	S_dev	46
	Scale factor =1 if OFF	0	ELE	39
	Weight =s/ if OFF	0	Info: S_dev_Z	0
	dHA *	45		
	S_dev	46		
	Info: S_dev_Z	0		
Note:	Info=Point list	0		
Only if Point List is on in configuration	Pno	5		
	Used raw data (Ang, Dist, Height)	0		
	dN	40		
	dE	41		
	dELE	42		
	Stn no	2		
	Stn coordinates	37, 38, (39)		
	RefObj=Blank	62		
	RefObj coordinates=0.000	37, 38, (39)	* dHA=correction value of the calculated bearing (orientation), which is normally a low figure.	
	HA_ref	21		
	HD=0	11		
	IH	3		

Here are the data that can be stored in the Job or Area file you have chosen, if you have activated the point list in the configuration routine.

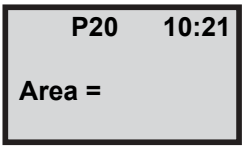
This is your old station ground elevation. Press YES (ENT) if you want to replace the old elevation with the new or press No to cancel it. In this example we press ENT. (This display will only appear if the ground elevation has already been determined).



Now the instrument is orientated. Do you want to store the point in an Area file answer this question with YES (ENT).

Note – *That the current instrument direction is stored as HA_ref.*

Key in the name of the Area file in which you want to store the point. Then press ENT.



In which memory unit is your Area file to be stored? In our example we are using the internal memory (Imem).

Note – *See next page for a list over the data that can be stored in the selected Job or Area file.*

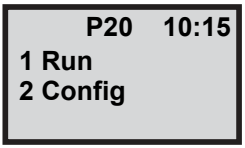
		Pointlist ON	
Job File		**Area File**	
Pno	5	Pno (Stn)	5
SH	6	N	37
Coord	37, 38, (39)	E	38
Raw data	7, 8, (9)	S_dev	46
Scale factor =1 if OFF	0	ELE	39
Weight =s/ if OFF	0	Info: S_dev_Z	0
dHA *	45		
S_dev	46		
Info: S_dev_Z	0		
Stn no	2		
Stn coordinates	37, 38, (39)		
RefObj=Blank	62		
RefObj coordinates=0.000	37, 38, (39)		
HA_ref	21		
HD=0	11		
IH	3		
* dHA=correction value of the calculated bearing (orientation), which is normally a low figure.			

Here are the data that can be stored in the Job or Area file you have chosen, if you have deactivated the point list in the configuration routine.

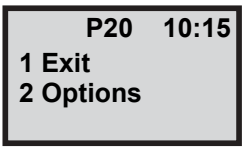
Free Station Configuration

In this example, we will describe in greater detail the routine in the free station establishment program called ”Config.”. This option can only be accessed when starting the program with a long press on the PRG-key, see page page 1-2.

Press 1 to start the program or select 2 to configurate the program. In this example we press 2. Config.



Press 1 Exit to return to the previous menu or press 2 options to start the configuration.
In this example we press 2.



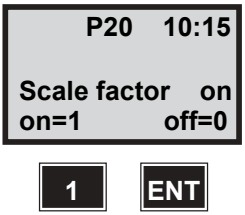
Here you are given an opportunity to activate/deactivate a scale factor. The scale factor for free station establishment is calculated and defined based on the internal relation between your known points.

The following applies for the scale factor:

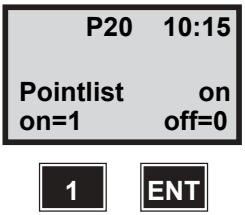
– Scale factor = 1.0000 if it is not activated (Off).

– If a UTM scale factor (F43) has been given, this value is multiplied by the scale factor calculated for free station establishment.
– The scale factor that has been used is displayed after calculation of your free station (see Free Station3-31).

In this example, we will activate the scale factor.



Here you can activate/deactivate a point list. In the list you will be able to analyse and alter any deviations for each point. The deviations are displayed as ”dev” (radial deviation) and ”RT.ofs/Radofs” (right offset and radial offset). figure 3.7.



Note – *For a more detailed explanation of how to work with the point list, see page 3-40.*

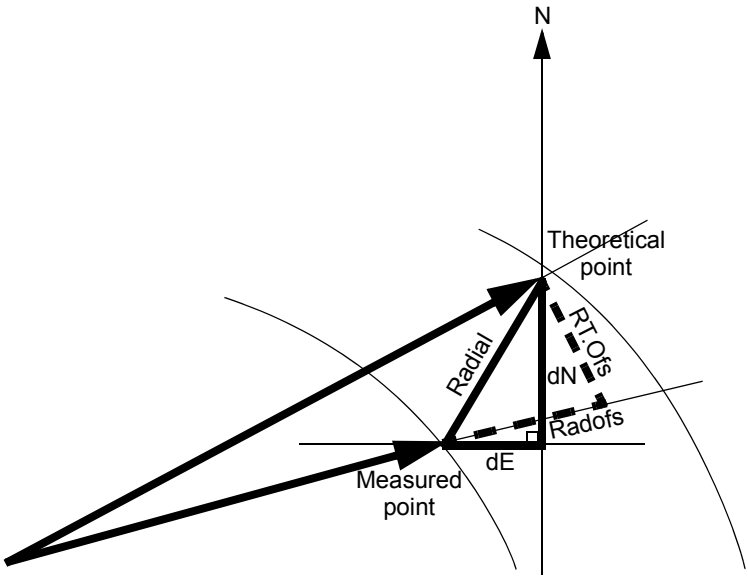


Figure 3.7 Definition of deviations presented in the point list

By using a weight factor you can give priority to your known points with reference to distance. To put it simply, points that are further from your free station have a lower priority than the points that are closer. This function is used mostly in Germany.

Normally no weight factor is used when the network is of good quality. This means that you should choose the weight factor that is defined as s/1.

By pressing the ENT key in steps you can produce three different bases of calculation for the weight factor (see the margin, left). These are intended mainly for Germany, and are not used otherwise. Since we will not be using this function and since weight factor s/1 is the default in position ON, you need press only ENT until the display shows...

```
      P20    10:15
Weight factor
s/1        on
on=1           off=0
```

Note – *Formulas for calculating the weight factor (for the German market).*

100/S

```
      P20    10:15
Weight factor
100/s          off
on=1           off=0
```

$1000/S^{3/2}$

```
      P20    10:15
Weight factor
1000/s **3 off
on=1           off=0
```

$1000/S^{2}$

```
      P20    10:15
Weight factor
1000/s **2 off
on=1           off=0
```

Here you can choose to continue with your free station establishment, or repeat your configuration. If you continue with free station establishment, press 1 and then choose 1 Run to start the program. See page 3-31 for instructions.

```
      P20    10:15
1 Exit
2 Options
```

Eccentric Station

Select Program 20.

PRG **2** **0** **ENT**

In this example, we will establish an eccentric station. The known points we will be using have been stored as Pno and coordinates in an Area file using P43 (Enter Coordinates).

Press ENT.

```
Stn estab.  10:19
1.Known Station
2.Free Station
3.Known Station+
```

ENT

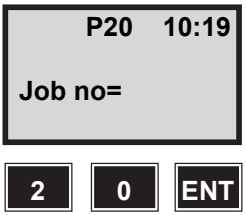
We will choose function 4, Eccentric Station.

```
Stn estab.  10:19
4.Ecce Station
```

4

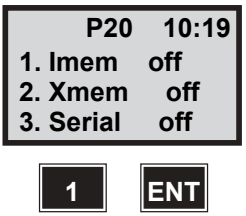
Here you key in the number or name of the Job file in which you wish to store data from your station establishment. A

list of data stored in the selected Job file can be seen on page 3-46 and page 3-49. Select, for example, Job no = 20.



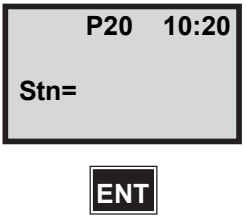
Note – *Only displayed if Job/Mem is switched on (MNU61)*

Where will you store your Job file? Choose a suitable memory unit by indicating 1, 2 or 3 for activation/deactivation. Then press ENT.

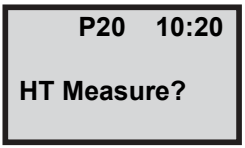


Note – *Only displayed if Job/Mem is switched on (MNU61)*

Here you enter a name/number for your eccentric station.

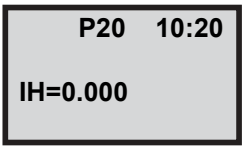


Are you going to measure heights? Accept this question by pressing YES (ENT). If you decide not to measure heights (press No) it means that the instrument height (IH) and signal height (SH) will be ignored. In this example, we will be measuring heights. Press YES.



YES

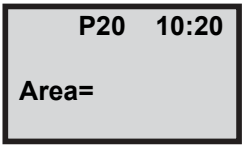
Enter your instrument height (IH). For example 1.75



1 . 7 5 ENT

Note – *Only shown if height should be determined*

Key in the name of the Area file in which you have stored your known Pno and coordinates. Then press ENT.



ENT

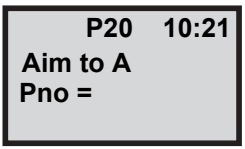
In which memory unit is your Area file stored? In our example, we are using the internal memory (Imem).

Note – *If you get Info 32 when selecting a memory unit, it may be due to one of the following:*

1. You have chosen the wrong memory unit.
2. The Area file you are looking for is not located in the memory you have selected.
3. The Stn (Pno) which you are looking for is not stored in the Area file you have selected.

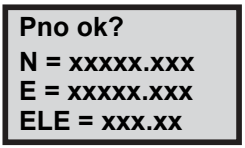
   The program will then return to the question ”Area =" so that you can enter another Area file number or point number.

Enter the number of the first point you want to aim at. Then press ENT.



Are your coordinates correct? Press YES (ENT) to accept them. If they have to be changed, use Edit or P43 (Enter

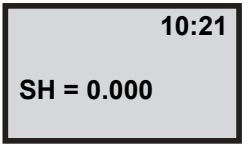
Coordinates). In this example we will continue by accepting them.



Note – *Only displayed if Confirmed is switched on (MNU 61)*

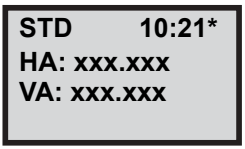
Enter the signal height (SH).

For example 2.1 and press ENT.



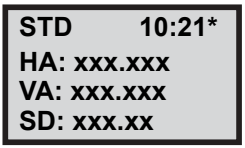
Note – *Only shown if height should be determined*

The instrument is now in theodolite position and is ready to measure. Aim at the chosen target. Press the A/M key if distance is to be measured, otherwise REG.

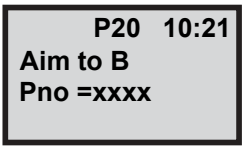


Note – *Distance measurement must be carried out when measuring heights.*

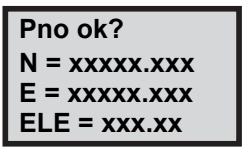
The instrument displays HA, VA and SD for your first point. Your measurement can now be registered. Press the REG key.



Enter the next Pno to be used for your free station (the display here shows the most recently used Pno). Then press ENT.

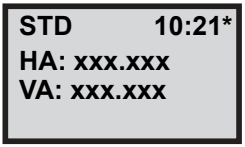


Are your coordinates correct? Press YES or NO. If they have to be changed, use Edit or P43 (Enter Coordinates). In this case, we'll answer YES.

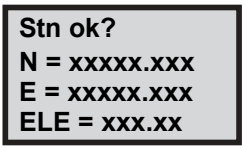


Note – *Only displayed if Confirmed is switched on (MNU 61)*

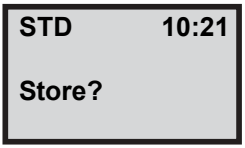
Aim at your target. Then press the REG to register the data.



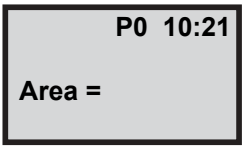
Is your station OK? Press YES if OK.



Now the instrument is orientated. Do you want to store the point in an Area file answer this question with YES (ENT).



Key in the name of the Area file in which you want to store the point. Then press ENT.



In which memory unit is your Area file to be stored? In our example we are using the internal memory (Imem).

CHAPTER

4

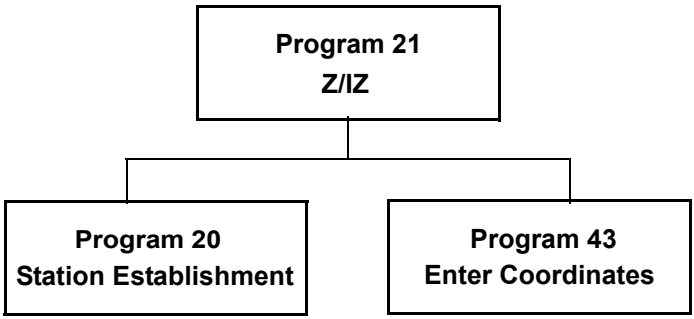
P21 Z/IZ

In General 4-2
How to use 4-3

In General

Z/IZ is a program for calculating instrument elevation. It will provide several results, such as the ground point elevation or the instrument point elevation. These are obtained by measuring the vertical angle and length of slope to one or more points of known height. This field calculation is also called ”instrument point elevation resection”, as the mean height and standard deviation are calculated from all the observations.

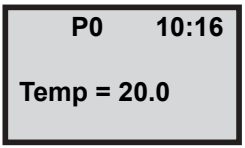
Z/IZ can be used in a number of applications. For example, it is naturally advantageous to combine Z/IZ and Station Establishment /Free Station when having established your station point in only two dimensions (N and E). By combining these two programs, the three-dimensional coordinates of a point can be calculated and stored in the same Area file and under the same point number in the memory unit you select. In such cases, free station establishment shall be carried out before measuring elevation. Z/IZ also includes P43 (Enter Coordinates).



How to use

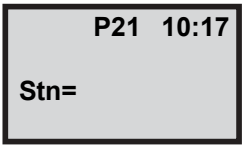
One application for which Z/IZ is ideal is to determine the height of a point whose coordinates are known — that is, in combination with P20 (Free Station function). In the example below, we have chosen to carry out this kind of measurement and calculation. It is assumed that you have already established your station (P20, see page 3-2) and that the points whose coordinates are known are stored in an Area file. However, P21 can also be used independently for height calculation.

The instrument's station has been established. Select program 21 (Z/IZ).



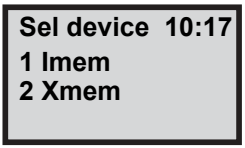
PRG 2 1 ENT

Key in your station number and press ENT.



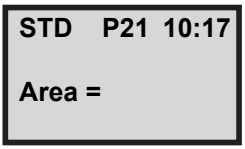
1 ENT

In what memory unit is your Area file stored? In this example, we are using the internal memory (Imem).



1

Key in the number of the Area file in which we have stored the points whose coordinates are known, which we shall be using to determine the height of our free station. In this example, these are located in Area = 2.

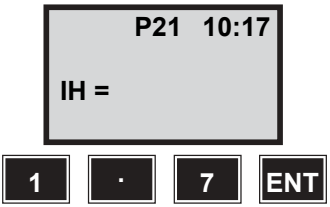


2 ENT

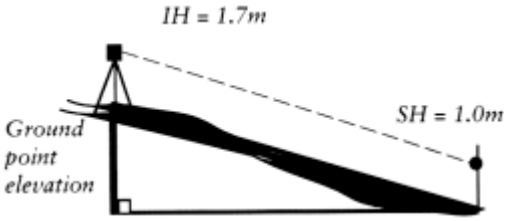
Note – *If you leave the Area file blank you will be able to manually key in point elevation later on.*

Here you decide whether you want to measure instrument point elevation or ground point elevation. If IH is given, the ground point elevation will be calculated. If no instrument height is given, the instrument point elevation will be

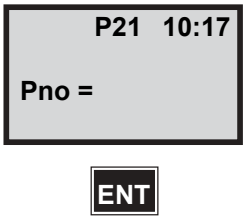
calculated. In this example, we assign IH = 1.7 m. Consequently the ground point elevation will be calculated.



Note – *This display will not be shown if you have left the Area file blank above.*

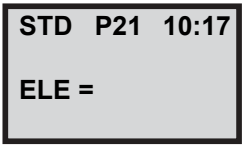


Give the point number for the first reference point stored in the Area file.



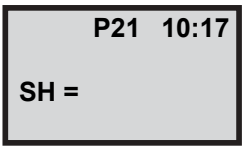
Note – *This display will not be shown if you have left the Area file blank above.*

The elevation is shown for the reference point selected.

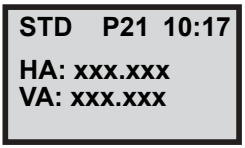


Note – *If you left the Area file blank earlier you are able to manually key in point elevation.*

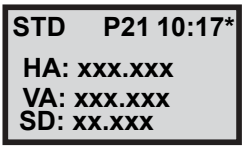
Here you give the signal height (SH). This must be given whether the instrument point elevation or ground point elevation is to be calculated. In this example, SH = 1.0 m.



Now you can begin to measure your first reference point. Aim and then press the A/M key.



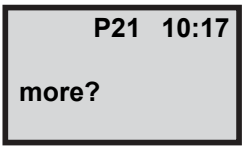
The display shows HA, VA and SD to Pno 1. Your measurement is now ready to be registered. Press the REG key.



REG

Will you use several points for your height calculation or will one point be enough? Note the following: Your result will indicate a mean elevation. This is presented as a difference if two points are included in the measurement. If, on the other hand, you use 3 or more points, a standard deviation (S_dev) is obtained, based on all the observations.

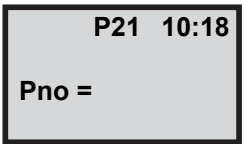
In this example we shall measure two additional points whose heights are known. Therefore answer the question with Yes (ENT).



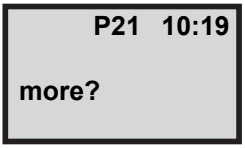
YES

Give reference point 2, which is to be used for height determination, and repeat the instruction above. In this example we have also measured and stored a third point. We assume now that these measurements are concluded

and we continue directly to the question ”more?” after storing Pno 3.

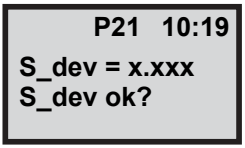


All the points to be used for height determination are now stored. Answer the question ”more?” with No. The program now immediately calculates any standard deviation.



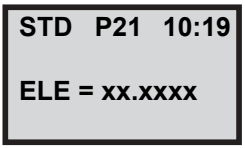
NO

This is the standard deviation based on all the observations. If the standard deviation or difference in elevation (in the case of 2 points) should be too large, answer the question (Diff ok?) S_dev ok? with No, and perform the measurements again.

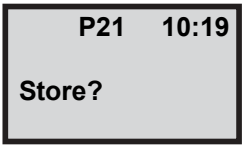


YES

This is the ground point elevation of your free station. Press ENT.

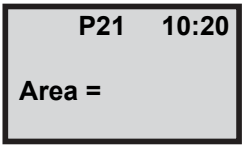


If the result of your calculation is to be used, the point must be stored in an Area file. Answer the question with Yes (ENT).



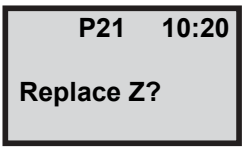
Note – *If no instrument height was given (see page 4-3 and the instrument point elevation was calculated, the question "Store?" will not appear. However, the instrument will retain the elevation data until it is switched off.*

In this example, we wish to store the elevation coordinates for our station point in the same Area file as the station coordinates for your free station. Select the same Area file in which your free station establishment is stored.



If an elevation already exists for the station point you are given the question "Replace Z?". Press Yes or ENT to store the new Z or press No to keep the old one.

The program now returns to PO and you can select the next program.



Here are the data stored in the Area file you have selected.

Area file
Pno(Stn)= ELE=

Note – *Data stored in the selected Area file.*

CHAPTER

5

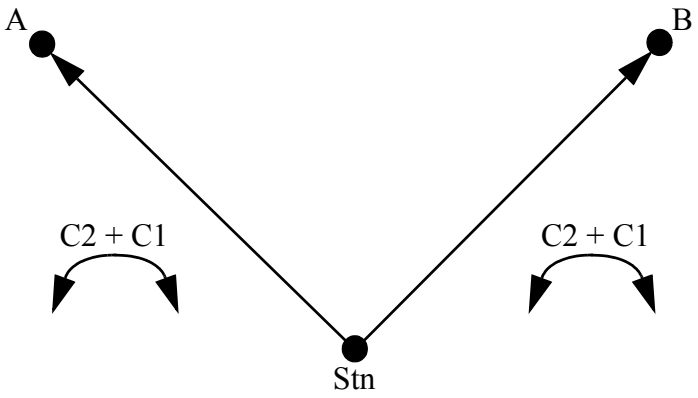
P22 Angle Measuring

In General 5-2
How to use 5-3

In General

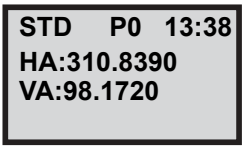
When using program 22, all you need to do is to locate the targets one time in C1. When all targets are located and stored in your internal or external memory (card memory), you are able to select the measuring mode in which you want to work: Standard or D-bar mode. Now the instrument's servo motors will do the rest. The instrument will rotate and point directly in CII against the first registered target, you will then make the necessary fine adjustments and registrations by pressing the A/M-key in front. For rotation to CI, depress the A/M key for a couple of seconds.

Note – *this program can only be used when using the station unit as a total station.*



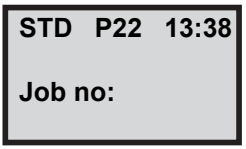
How to use

The Geodimeter CU is now in program 0 (P0). Choose program 22 - Angle Measurement.



PRG 2 2 ENT

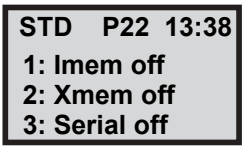
The program name "2 face Ang. Meas." is seen very briefly on the display followed by request of which Job file you want to store your angle measurements in. Key in, for example, 16...



ENT

Note – *Displayed if Job/Mem is switched on (MNU61)*

Here you select which memory device you wish to store the Job file in. 1: Imem.

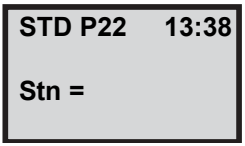


1 ENT

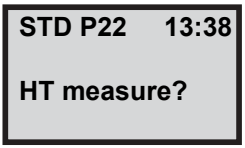
Note – *Only displayed if Job/Mem is switched on (MNU61)*

Note – *See Geodimeter CU General.*

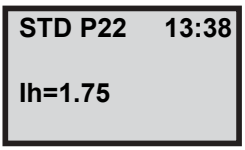
Key in the Stn. point name / number– e.g 1000. Press ENT.



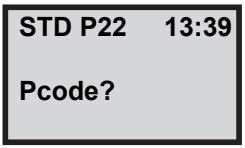
If heights are to be measured the next question would be IH (instrument height). In this example we will press NO, which means that instrument and signal height is not taken into account.



Key in your instrument height Ih, e.g. 1.75 and press ENT.

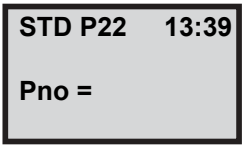


Here you have the opportunity to choose the numerical value of the Pcode (Pcode is additional software). We will answer NO...



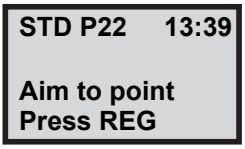
NO

Key in the number of the first target at which you wish to begin your angle measurement, e.g. 200 ENT...



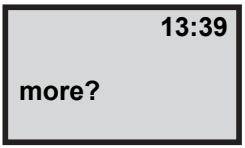
ENT

Make a coarse aiming towards the first target, then press REG...



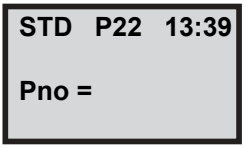
REG

In this example we will continue to measure towards more targets. Press YES...



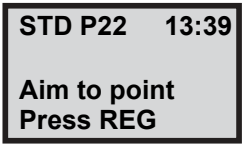
YES

Key in the second target number – e.g., 201 ENT...



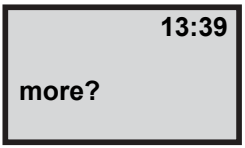
ENT

Make a coarse aiming towards the second target, then press REG...

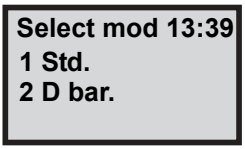


REG

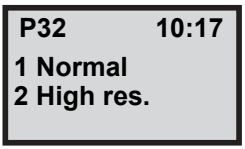
Repeat the instructions above for your following targets. When all your targets are stored you will answer no to this question. Press NO...



The program gives you the opportunity to select in which measuring mode you want to work. In this example we will select No. 2= D-bar mode...

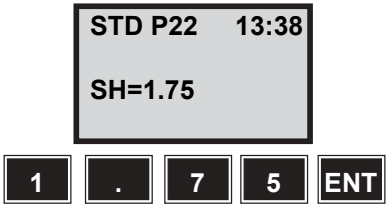


Select normal or high resolution, in this case we will select normal.



Note – *This display will only appear if you have a Trimble 5601.*

Key in your signal height SH, e.g. 1.75 and press ENT.



The instrument starts to rotate to C2 position, aiming at target No. 200.

The number of sightings is entirely up to you, the operator, and will depend mainly on the visibility conditions and the type and required accuracy of the survey work. In this example we have chosen to make two sightings in C2.

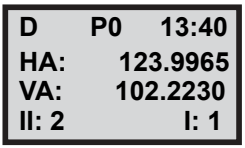
Approach the target from the other direction using the motion screws and press A/M...

Press in front and Press in front a second time.

After pressing A/M the second time, the mean of angular C2 values is stored in the memory of the instrument. The rule when measuring angles in this mode is that the same number of sightings must be made in both C2 and C1. Rotate the instrument to C1 position by depressing the A/M key in front for approx. 2 sec.

Press in front

Approach the target from the other direction using the motion screws. Press A/M.

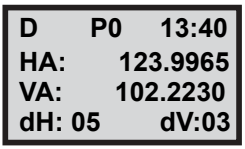


The second C1 angle measurement and indication of completion (i.e., II:2) is very quickly shown on the display.

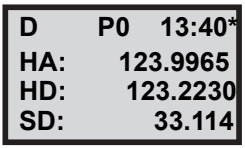
However, the values now seen on the display are the final mean horizontal and vertical angle values of the mean of the angles measured in both faces.

The dH & dV values displayed are the amounts by which the angles have been adjusted – i.e., half the sum of the remaining horizontal and vertical collimation and pointing errors.

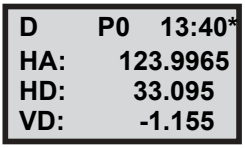
Now it is time to measure the distance. Press A/M or REG if length is not to be measured.



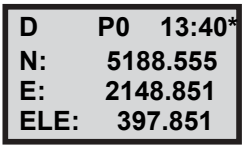
Distance is continually measured and updated while mean angular values are frozen.
To view the HD and VD to the point, press ENT...



To view the N, E and ELE of the point...



To continue, press the REG key and the instrument will aim at the next target in C2 position. Repeat the instructions above.



Note – *After the last point your are prompted "Repeat ?" If answering Yes to this question, all points are remeasured.*

The following data is stored in the chosen Job file after pressing the REG key.

Job file	
Stn	
IH	If measuring heights
Pno	
Pcode	If Pcode is entered
HA	
VA	
SD	If distance measurement has be done
HAII	0 if no measurement in face 2
VAII	0 if no measurement in face 2
HAI	0 if no measurement in face 2 D-mode
VAI	0 if no measurement in face 2 D-mode
.	
.	

CHAPTER

6

P23 SetOut

In General 6-2
SetOut Point Data 6-2
Automatic Check of Set Out Point´s Position 6-2
How to use 6-3
Countdown to Zero Method 6-6
Radial/Right Angle Offset Method 6-9

In General

SetOut will allow you to set out points in the field much quicker and will also give you access to an automatic point check and storage routine.

SetOut Point Data

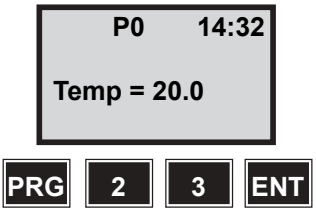
Storage of coordinates and heights of known points is carried out with Program 43 - ENTER COORD. Use of Program 43 means manual keying in of the points. Point storage can be carried out either in card memory or Internal Memory. During the running of programs 20/23, the stored coordinates are recalled from the specified memory device and are used for both orientation of the instrument station and calculation of the bearing and horizontal distance to the set out points.

Automatic Check of Set Out Point´s Position

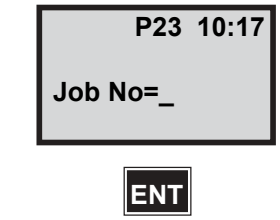
After having set out the point, you can check its position accuracy relative to the stored point coordinates and height. These deviations are displayed in form of radial and right angle offsets plus height difference. The ± signs of these deviations corresponds to left and right in relation to the point´s correct theoretical position. Once the point has been set out i.e. when the offset values are zero or almost zero, P23 allows the deviations dN, dE and dELE to be stored in card memory or Internal Memory. As a final check, the point´s present actual coordinates i.e. N, E and ELE can be viewed and compared with the correct theoretical point coordinates and elevation. If you would also like to store these N, E and ELE values, we recommend that you configurate the user defined output table (see page 1-4).

How to use

The instrument's station has been established. Select program 23 (SetOut).

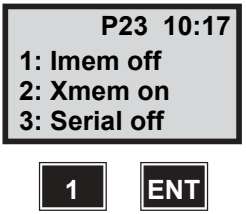


Key in the number of the Jobfile in which you want to store the set out point data. Then press ENT.



Note – *Displayed if Job/Mem is switched on (MNU61)*

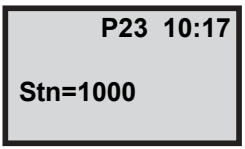
Activate the device you wish for storage of the Job file by choosing the appropriate number 1, 2 or 3.



Note – *Only displayed if Job/Mem is switched on (MNU61)*

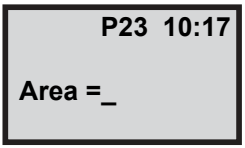
This was the Station No. you entered in program 20, Station Establishment. Press ENT.

If no station establishment has been made, P23 will automatically propose establishment of a known or free station (P20) when you press ENT. See page 3-2.

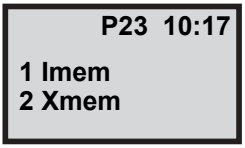


Note – *Only displayed if Stn is switched on (MNU61)*

Key in the Area file number in which the set out point coordinates are stored and press ENT.

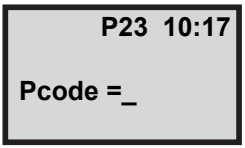


Choose what type of device in which the points are stored. If heights are to be set out, next question would be SH=.



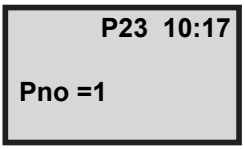
Note – *Signal Height*

If you have entered a Pcode for the set out point you can enter the desired Pcode here. The program will then seek for the point with that Pcode. If you have no Pcode just leave the line blank and press ENT.



ENT

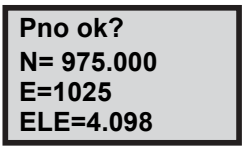
The program suggests the first point in the Areafile. Accept it or key in the point number at which you wish to begin with your setting out task. In this example we key in 206.



2 0 6 ENT

Note – *If you have more than one point in the Areafile to set out the program will automatically suggest the next point.*

Check the coordinates and answer YES to accept them or NO.



YES

The instrument now automatically switches to the TRK-mode.

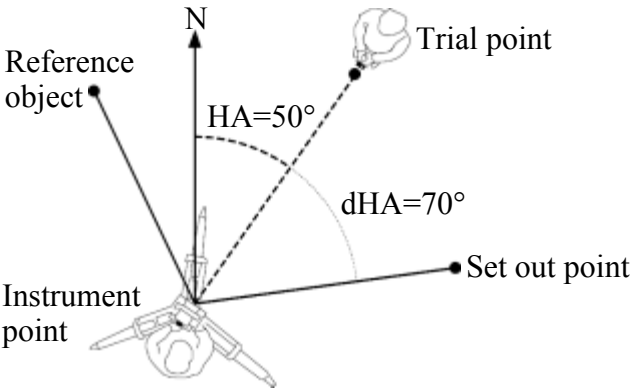
The instrument should be rotated to the right + 70.000 degrees.

```
TRK   P23  10:17

HA:    50.000
dHA: 70.000
```

- = Left
+ = Right

Note – *If you have servo you can rotate the instrument by pressing the key*

Here follows the count down to zero angle method. See page 6-9 for the radial/right angle method.



Countdown to Zero Method

When the instrument displays dHA approx. 0.0000 it is pointing in the direction of the point to set out.

HA is the calculated bearing to the set out point.

```
TRK   P23  10:17

HA:   120.0000
dHA:   0.0000
```

As soon as the prism comes within the measurement beam you will see dHD=remaining. In this case the prism is on line but the distance has to be increased by 2.75m.

```
TRK   P23  10:17
dHA:   0.0000
dHD:   2.75
dHT:   0.155
```

Note – *Measurement tip!*
It is convenient to decrease the number of decimals in the Label 77=dHA. This can be done via menu 13.

The point is now set out. Press ENT to check the points coordinates and deviations to the theoretical set out point. Switch to STD or D-bar mode to check the point more accurately.

```
TRK   P23  10:17
dHA:   0.0000
dHD:   0.00
dHT:   0.000
```

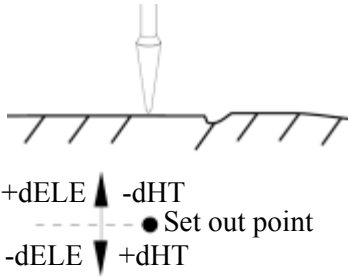
Note – *Rotate the instrument with servo!*

If you press without measured distance ELE=the height at the theoretical set out point.

If you press with measured distance ELE=the height at the measured set out point.

If you press longer than 1 sec. with measured

distance ELE=the height at the theoretical set out point.



When the radial offset, right angle offset and dHT are 0.00, the correct lateral set out position and height have been set out.

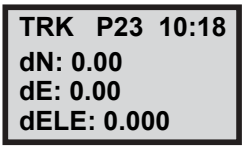
```
TRK   P23  10:18
Radofs:  0.00
RT.  ofs:  0.00
dHT: 0.000
```

ENT

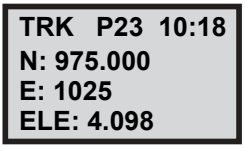
Note – *Skip point!*
If you have difficulties to set out the point, the program will give you a opportunity to skip it. Turn the instrument away from the prism when HA and dHA are displayed and press Reg. The question "Skip Point?" will be displayed. Answer YES to this question and the program will continue with the next setting out point.

When you press REG, these are the three values which are stored in the memory, i.e. deviations from the correct set out point coordinates. Press REG to record deviations or

ENT to see coord. of the set out point. In this example we press ENT.



These are the actual coordinates of the set out point´s present position. Press REG to store the deviations.

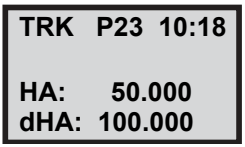


Note – *Only displayed if Confirmed is switched on (MNU 61)*

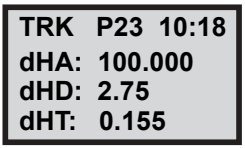
The program continues with the next set out point. Press the PRG-key and 0 to exit to theodolite mode.

Radial/Right Angle Offset Method

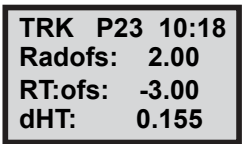
Aim the instrument towards the prism bearer.



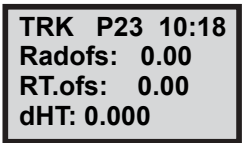
When the prism comes within the measurement beam you will see dHD=remaining. Press ENT to see the values for radial and right angle offsets.

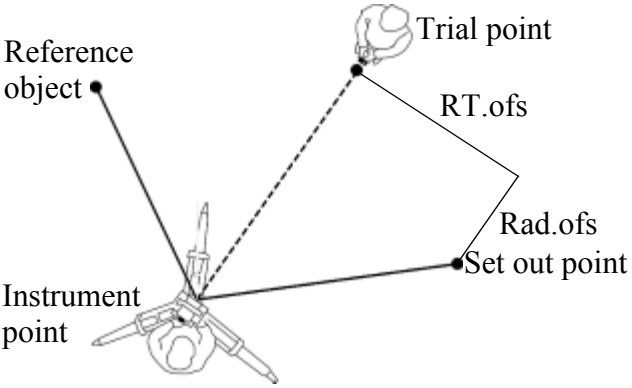


In this case the prism should be moved 3 meters towards the instrument and 2 meters to the left. The instrument should also be tilted up 0.155 meters.



When the radial offset, right angle offset and dHT are 0.00, the correct lateral set out position and height have been set out.





When you press REG, these are the three values which are stored in the Imem, i.e. deviations from the correct set out point coordinates. Press REG to record deviations or ENT to see coord. of the set out point. In this example we press ENT.

```
TRK   P23  10:18
dN: 0.00
dE: 0.00
dELE: 0.000
```

ENT

These are the actual coordinates of the set out point´s present position. Press REG to store the deviations.

```
TRK   P23  10:18
N: 975.00
E: 1025.00
ELE: 4.098
```

REG

The program continues with the next set out point. Press the PRG-key and 0 to exit to theodolite mode.

Note – *Skip point!*
If you have difficulties to set out the point, the program will give you a opportunity to skip it. Turn the instrument away from the prism when HA and dHA are displayed and press Reg. The question "Skip Point?" will be displayed. Answer YES to this question and the program will continue with the next setting out point.

CHAPTER

7

P24 RefLine

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  Straight Line 7-8
  Radius 7-10
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In General

RefLine is a program with many applications in the field. The idea is to measure markings along, or parallel to, a predetermined line. If, for example, you have two points whose coordinates are known, you can use this program to place any number of points along the line or, at a specified distance, parallel to it.

It does not matter whether you have visibility between the points or not. Nor does it matter if you go beyond the line's end points. The program will maintain the direction of the line independent of distance. The program can be used for a variety of applications in the field — for example, setting out for pipelines or electric power lines, constructing facade walls on profiles, for drainage ditches, along roadways, etc.

RefLine (P24) also contains P20 (Station Establishment) and P43 (Enter Coordinates).

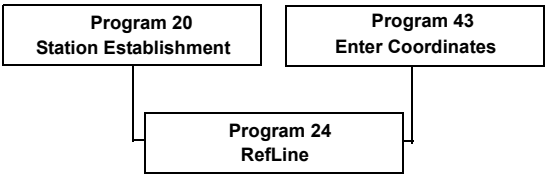


Figure 7.8 Programs included in Refline

The program is divided into two different parts:

- Known or Unknown line

  You can enter the coordinates for the reference line if they are known or construct a reference line by measuring two points. In the first case it is necessary to have established the station before using the program otherwise the program will automatically propose station establishment, P20. In the second case you don't

establish the station since the program will create a new coordinate system with origo in the first point in the reference line.

- Measure or SetOut

  In the second part you can choose between measure and set out points from the reference line.

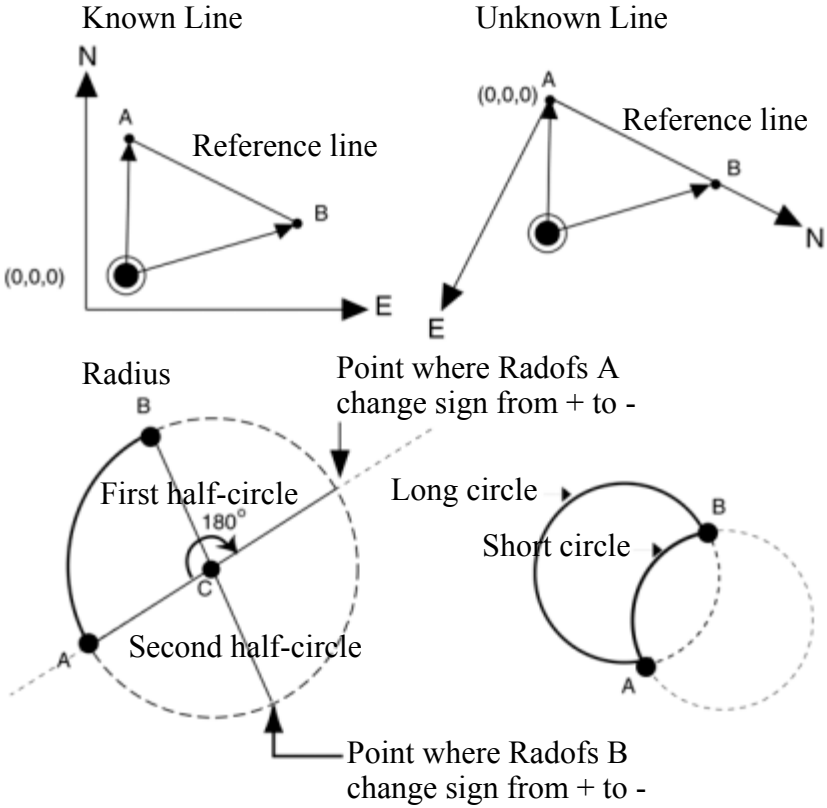


Figure 7.9

Configure

To get to Configure, make a long press on PRG key, select Refline and press ENT.

PRG

Press 2 to Configure.

```
    P24     10:15

1Start
2 Configure
```

2

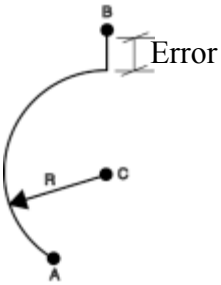
Here you can configure Radius limits and switches.

```
    P24     10:15

4 Radius limits
5 Switches
```

Press 4 to key in Radius Error, only valid for A+B+Radius and A+B+C.

```
    P24     10:15

Error limits
Radius error=
```

4



Press 5 to configure switches.

```
        P24   10:15
1 Ask circ.seg?Yes/No
2 Slope percent
3 dHT (not dELE)
```

5

Ask circ. seg?- If you will be working in the first half circle, set this question to “No” and you will not get the question “First Halfcircle?” when you start measure.

Slope in% or %o.

Show dHT or dELE when measuring.

Start RefLine

Select program 24 (RefLine).

PRG 2 4 ENT

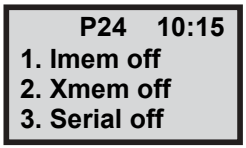
Key in the number or name of the Job file in which you wish to store data about your reference line. A list of data stored in the selected Job file can be seen on page 7-34.

```
      P24   10:15

Job no=
```

ENT

Note – *Displayed if Job/Mem is switched on (MNU61)*

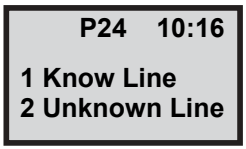
Choose in which memory unit you wish to store your Job file. Activate/deactivate a memory unit by pressing its corresponding key number and ENT.



Note – *Only displayed if Job/Mem is switched on (MNU61)*

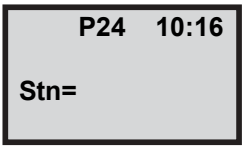
Known Line

Choose 1 if you have already stored the coordinates for the points in the reference line or choose 2 to measure them (See “Unknown line”, on page 7-14). In this example we choose 1 since we already have stored the points.



If no station establishment has been made, P24 will automatically propose a new station establishment (that is,

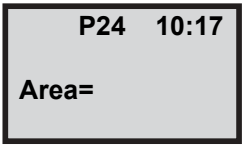
P20, StnEst) when you press ENT. In this example, we will continue by accepting the suggested station. Press ENT.



ENT

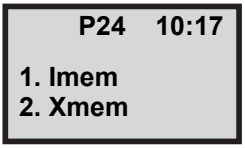
Note – *Only displayed if Stn is switched on (MNU61)*

Key in the name of the Area file in which we have stored the points whose coordinates are known, which we shall be using to establish our reference line.



ENT

In which memory unit is the Area file stored? In this example we are using the internal memory (1 = Imem).

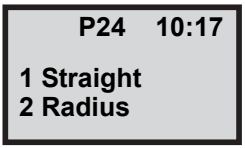


1

Note – *Only displayed if you selected a new Area file*

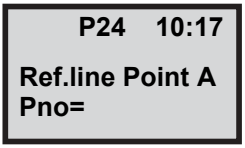
Straight Line

Select 1 Straight line, press 1. For 2 Radius, go to page page 7-10



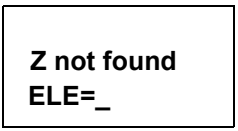
1

Key in the point number for point A on your reference line.

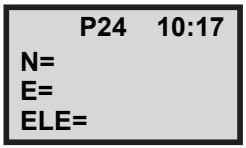


ENT

If you have chosen to include heights in your station establishment and ELE is missing for the point the following display appears and you must enter the elevation manually:

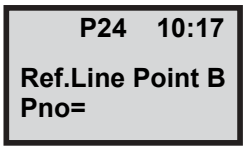


Are your coordinates correct? Press ENT to accept them. If they have to be changed, press NO and use Edit or P43 Enter coordinates).



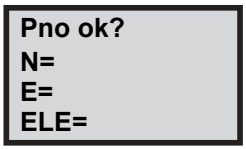
Note – *Only displayed if Confirmed is switched on (MNU 61)*

Key in the point number for point B on your reference line.



Note – *If ELE is missing you can enter it manually.*

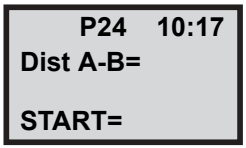
Are your coordinates correct? Press ENT to accept them. If they have to be changed, press NO and use Edit or P43 (Enter Coordinates). We will continue by accepting them.



Note – *Only displayed if Confirmed is switched on (MNU 61)*

DIST A-B, Show s the horizontal value between point A and B.

START shows the radofs. Start value from point A.

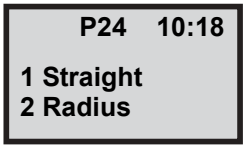


To measure, go to page 7-18

To setout, See “Setout with Radofs/Rt.ofs”. on page 7-23 or Set out with coordinates, on page 7-29

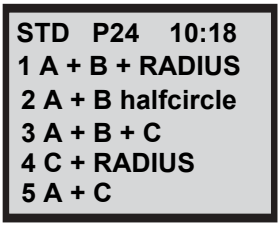
Radius

To choose radius, press 2.



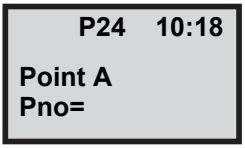
We choose 1 A+B+RADIUS.

See figure 7.9 on page 7-3



1

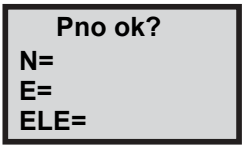
Key in the point number for point A on your reference line.



ENT

Are your coordinates correct? Press ENT to accept them. If they have to be changed, press NO and use Edit or P43 (Enter Coordinates).

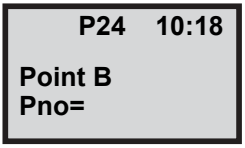
We will continue by accepting them



ENT

Note – *Only displayed if Confirm is switched on (MNU61)*

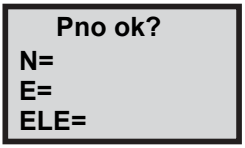
Key in the point number for point B on your reference line.



ENT

Are your coordinates correct? Press ENT to accept them. If they have to be changed, press NO and use Edit or P43 (Enter Coordinates).

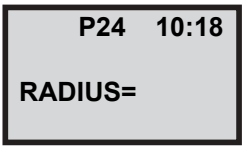
We will continue by accepting them.



ENT

Note – *Only displayed if Confirm is switched on (MNU61)*

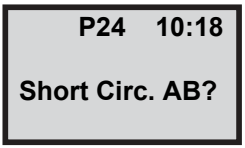
Key in the radius.



ENT

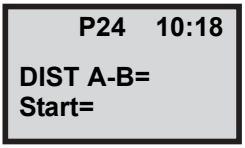
Do you want to measure along the Short Circle?
(See figure 7.10 on page 7-21. In this example we press

YES. If you press NO the question “Long Circ. AB?” will appear.



DIST A-B displays the horizontal value between point A and B.

Start shows the start value from point A.

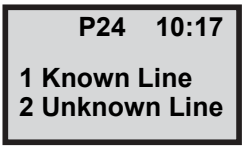


To Measure, go to page 7-18.

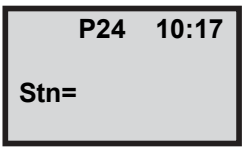
To setout, See “Setout with Radofs/Rt.ofs”, on page 7-23 or Setout with coordinates, on page 7-29

Unknown Line

In this example we choose 2 since we want to measure two points and use them as reference line.

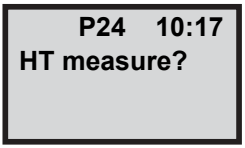


Key in your Station.

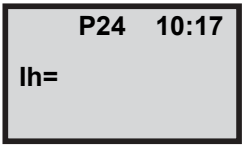


Are you going to measure heights?

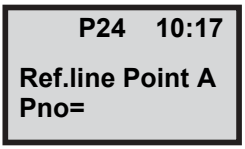
If you decide not to measure heights it means that the instrument height (IH) and signal height (SH) will be ignored. In this example we choose to measure heights. Press YES or ENT.



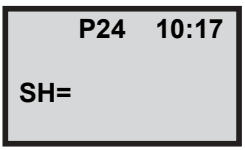
Enter the instrument height and press ENT.



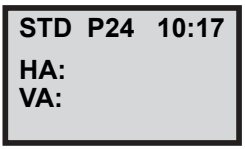
Key in the point number for point A on your reference line.



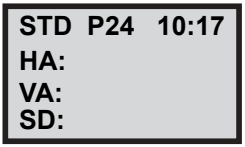
Enter the signal height and press ENT.



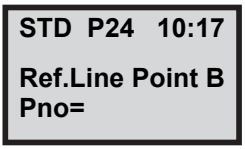
Aim at the first point, pnt A and press A/M to start measurement.



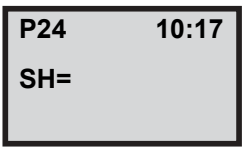
When you are ready press REG to store the point.



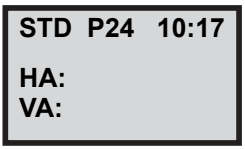
Key in the point number for point B on your reference line.



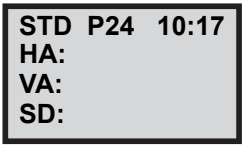
Enter the signal height and press ENT.



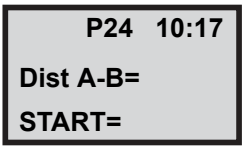
Aim at the second point, pnt B, and press A/M to start measurement.



When you are ready press REG to store the point.



The horizontal value between point A-B is displayed.
Start shows the start value from point A.



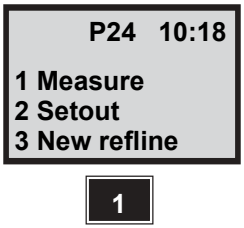
To measure, go to page 7-18.
To Setout, See “Setout with Radofs/Rt.ofs”, on page 7-23 or Setout with coordinates, on page 7-29.

Measure

Choose whether you which to measure, set out points relative your reference line or select a new refline. You can also exit from the program.

In this case we choose to measure points. Press 1.

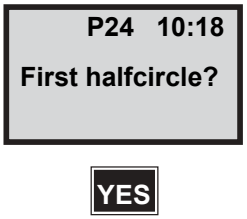
See page 7-23 for Setout instructions.



If you are measuring a radius, this question will come up. Do you want to work in the first half circle? Se figure 7.10 on page page 7-2

In this example we press YES.

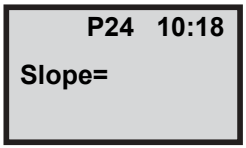
If you press NO the question “Second halfcircle?” will appear.



Note – *Only asked if the switch: “Ask circ. seg?” is set to yes*

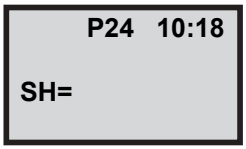
The program has calculated a slope for the reference line with help of the points A and B. Accept it or key in a new

slope. The slope of the line is a negative figure for a downward slope, and a positive figure for an upward slope.



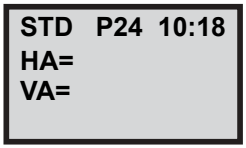
ENT

Enter the signal height.



ENT

Aim at the first point and press A/M to start measurement.

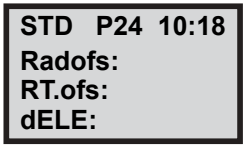


A/M

Note – *You can also change to another measurement mode at this point (TRK or D-bar).*

Radofs is a definition of how far your measured point lies from point A. RT.ofs is defined as the right-angle distance from reference line AB.

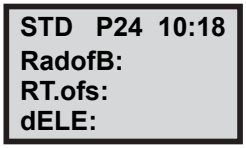
dELE is the difference in height from point A. If you have defined a slope, dELE is calculated as the deviation from the theoretical point.



ENT

See figure 7.10 “Offset definitions measuring mode on page 7-21, for offset definitions.

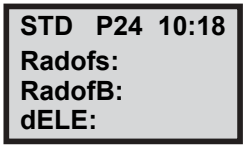
RadofB is a definition of how far your measured point lies from point B.



ENT

Note – *Not displayed if point B is absent*

The offsets are displayed. To register the point, press REG.



REG

Note – *Not displayed if point B is absent*

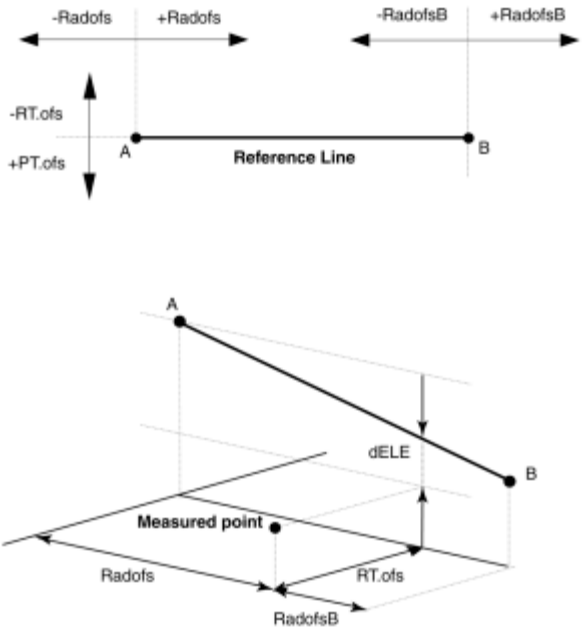
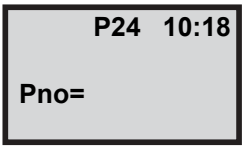


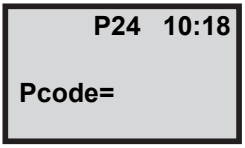
Figure 7.10 Offset definitions measuring mode

What name/number will you give your new control point? Key in the name and ENT to store Pno, SH, Radofs, RT.ofs, dELE, and the coordinates, in the Job file you have chosen in Imem. The program will automatically continue with the next point. See page 7-34 for a list of what is stored in after registration.



Here you have the opportunity to chose a Pcode for the measured point. The numerical value you enter corresponds to an alpha title which you enter with Program 45, Pcode.

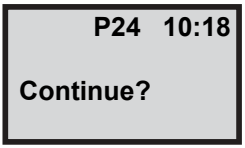
If you leave the line blank the question will not appear for the next point.



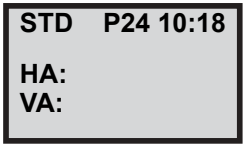
ENT

Note – *If you want Pcode to be stored, it must be added in the output table.*

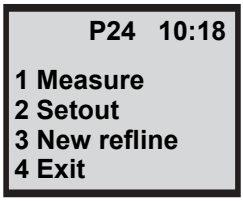
Do you which to measure more points press Yes or ENT, otherwise press NO to step to the mode menu.



YES

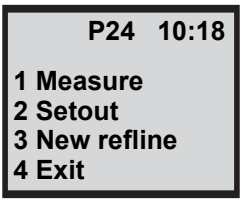


NO



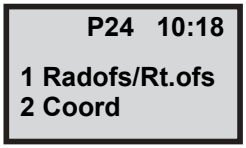
Setout With Radofs/Rt.ofs

Choose whether your wish to measure or set out points relative your reference line. Your can also exit from the program with 4. In this case we choose to setout points. Press 2.



2

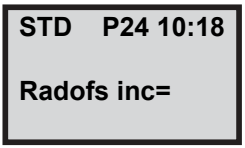
This menu will only appear if you have a known reference line. Choose 1 to set out with Radofs and Rt.ofs.



1

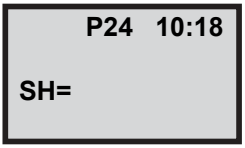
See page 7-29 for instructions of how to set our with coordinates.

Here your are able to key in which Radofs increment you want to use.



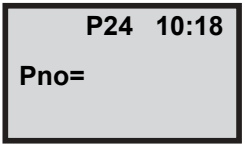
ENT

Enter the signal height.



ENT

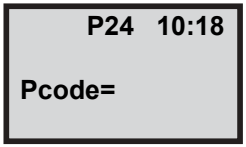
Enter a number for the first point you wish to set out. The program will automatically increment the point number when you continue with the next point.



ENT

Here you have the opportunity to choose a Pcode for the point you want to set out. The numerical value you enter corresponds to an alpha title which you enter with Program 45, Pcode.

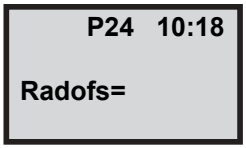
If you leave the line blank the question will not appear for the next point.



ENT

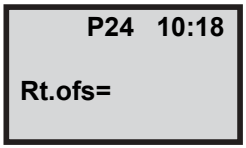
Note – *If you want Pcode to be stored, it must be added in the output table.*

Enter the radial offset to the set out point. See figure 7.11 on page 7-26.



ENT

Enter the right angle offset to the set out point. See figure 7.11 on page 7-26.



ENT

Calculated height for the set out point.

```
      P24  10:18

SHT=
```

ENT

The instrument switches to TRK-mode. When dHA:. the instrument is pointing in the direction of the set out point. As soon as the prism comes within the measurement beam you will se dHD=remaining. Press ENT to see the values for radial and right angle off-sets or press REG to register the point.

```
TRK          10:18
dHA:
dHD:
dHT:
```

ENT / **REG**

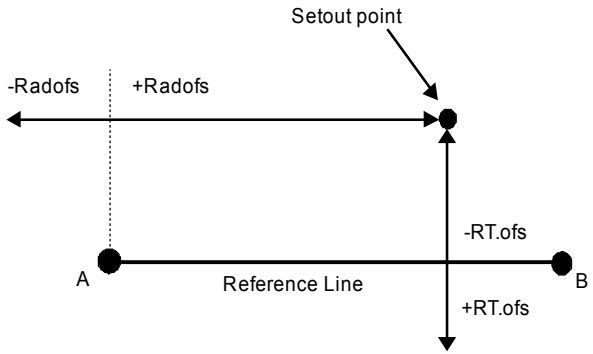


Figure 7.11 Offset definitions set out with Radofs/RT.ofs.

When the radial offset, right angle offset and dHT are 0.00, the correct lateral set out point position and height have been set out. See figure 7.12 on page 7-27 for offset definitions.

```
TRK   P24  10:18
Radofs:
RT.ofs:
dHT:
```

ENT / REG

Press REG to register the set out deviations, see figure 7.12 on page 7-27, or press ENT to see the coordinates of the set out point.

```
TRK   P24  10:18
dN:
dE:
dELE:
```

ENT / REG

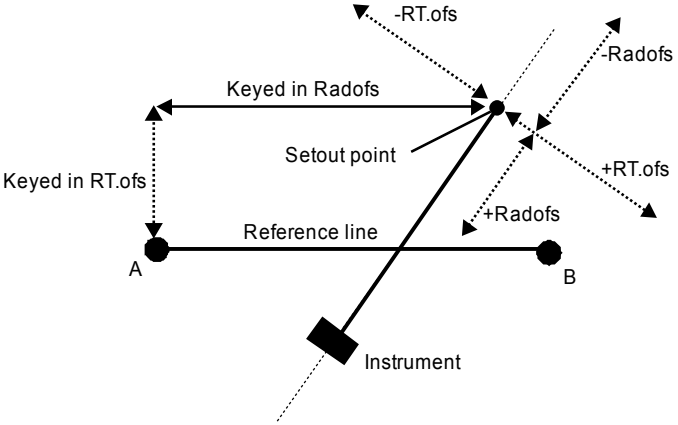
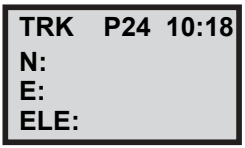


Figure 7.12 Offset definitions set out mode.

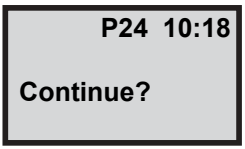
These are the actual coordinates of the set out point´s position. Press REG to store the deviations.

See “Registered data”, on page 7-34 to view a list of what is stored in the memory.

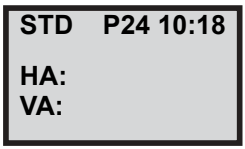


REG

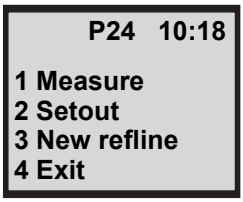
Do you wish to set out more points press YES. Press NO to exit to the mode menu.



YES

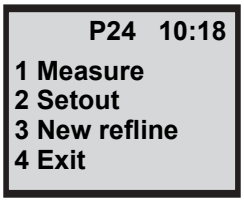


NO



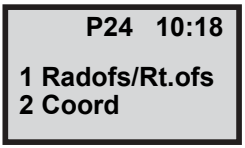
SetOut With Coordinates

In this case we are going to set out point with known coordinates. This is only possible if we have a known reference line.



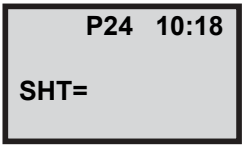
2

Choose 2 to set out points with known coordinates. This section is similar to Program 23, SetOut. (This option is not available for the unknown line).



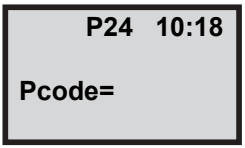
2

Enter the signal height.



ENT

If you have stored a Pcode for the set out point in the area file, you can enter the desired Pcode here. The program will then seek for the point with this Pcode.

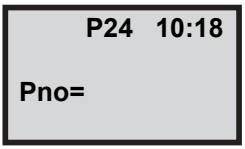


ENT

If you don't have any Pcode or have many different Pcodes and want to use them all, just leave the line blank and press ENT.

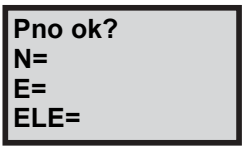
The program suggests the first point in the Areafile. Accept it or key a new.

Press ENT.



ENT

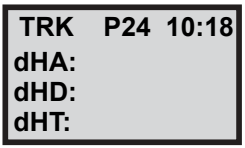
Check the coordinates and answer YES to accept them or NO.



ENT

Note – *Only displayed if Confirm is switched on (MNU61)*

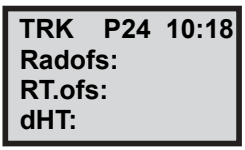
When dHA: 0.0000 the instrument is pointing in the direction of the set out point. As soon as the prism comes within the measurement beam you will see dHD=remaining. Press ENT to see the values for radial and right angle offsets or press REG to register the point.



ENT / REG

When the radial offset, right angle offset and dHT are 0.00, the correct lateral set out point position and height have been set out.

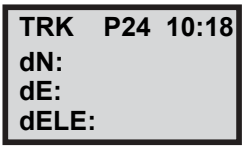
Se figure 7.12 on page 7-27, for the definitions of radial and right angle offsets.



ENT / REG

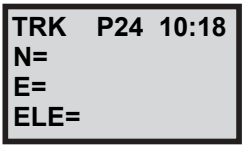
When you press the REG key, these are the three values which are stored in the memory, i.e. deviations from the correct set out point coordinates. Press REG to register the

deviations or press ENT to see coordinates of the set out point.



ENT / REG

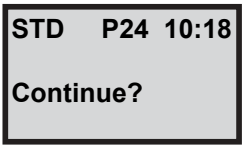
These are the actual coordinates of the set out point´s position. Press REG to store the deviations.



ENT / REG

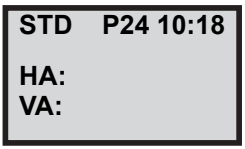
See page 7-34 “Registered Data” for a list of what is stored in the memory.

Do you wish to set out more points press YES. Press NO to exit to the mode menu.

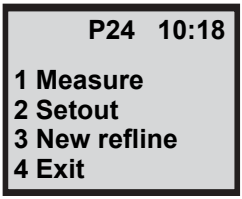


ENT / REG

YES


STD P24 10:18
HA:
VA:

NO


P24 10:18
1 Measure
2 Setout
3 New refline
4 Exit

Registered Data

The list below shows which data will be stored after registration.

Job file in Imem	Comment
Stn Coord.	Station Establishment
RefObj. Coord	
HAref	
HD	Distance to ref. obj. (known Stn.)
IH	
INFO	Point A
Pno1 (A). Coord[1]	Coordinates for the reference line
INFO	Point B and/or C
Pno2 (B). Coord[1]	
INFO	Start
Slope	
Measure Mode	
INFO	Refline measure
Pno 1.	Measured data, control points
SH	
Coord	
Radofs[2]	
RT.ofs[2]	
dELE	
Setout mode with Radofs/RT.ofs	
INFO	Refline setout
Pno	Setout data, control points
Radofs	
Rt.ofs	
ELE	
dN	
dE	
dELE	

Setout mode with coordinates	
INFO	Refline setout with coordinates
pNO	Setout data, control points
dN	Coordinate deviation
dE	
dELE	

1. Stored only if using a known reference line
2. Relative the reference line

CHAPTER

8

P25 Area Calculation

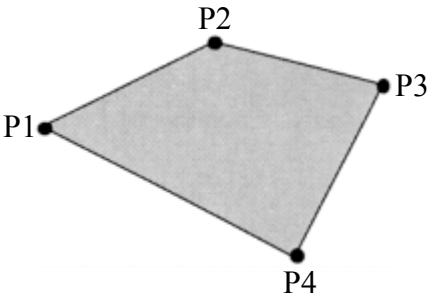
In General 8-2
1. Calc 8-2
2. Arrange List 8-2
3. Volume 8-3
How to use 8-4

In General

With program 25 you are able to calculate the area and the volume between measured point. The program contains three main functions:

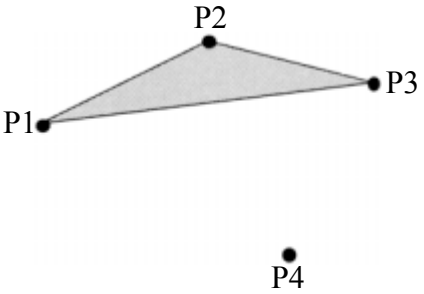
1. Calc

With this function you can calculate the area between measured points in the order they are registered.



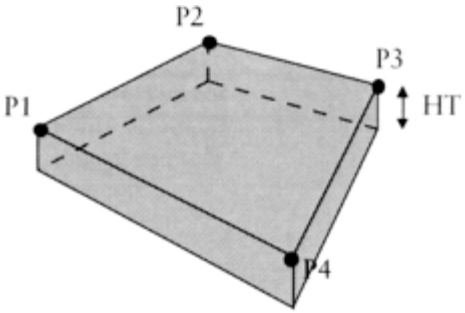
2. Arrange List

With this function you can arrange a list of measured points and calculate the area between the points in the order they are arranged in the list.



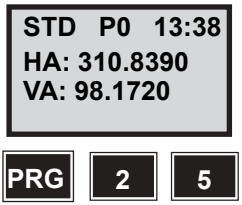
3. Volume

With this function you can enter a height for the area and calculate the volume.

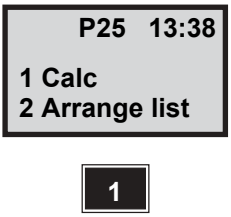


How to use

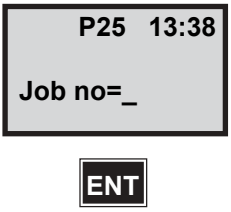
The Geodimeter is now in program 0 (P0). Choose program 25 – Area Calc.



Here can choose if you want to calculate the area in the order the points are measured (1 Calc) or if you want to arrange the points in a different order and calculate that area. Here we choose 1 Calc.



Key in the Job file in which the measured points are stored and press ENT.

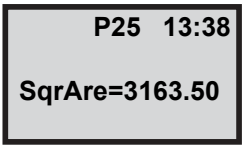


Note – *Displayed if Job/Mem is switched on (MNU61)*

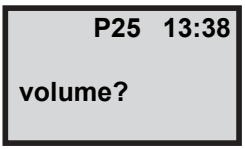
In which memory unit is the Job file located. In this example it is in the internal memory. Press 1.

Note – *If Info 32 appears it may be that the Job file you have keyed in does not exist in the chosen memory unit or if you are using an external memory that the connections are bad. If Info 44 appears it may be that the Job file does not contain right point data.*

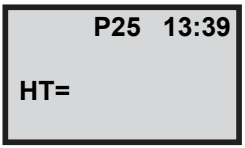
Here is the calculated area. Press enter to continue.



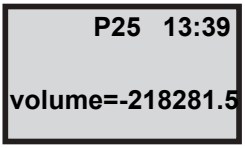
Do you want to calculate a volume. Press YES to accept or NO to cancel. In this case we accept with YES.



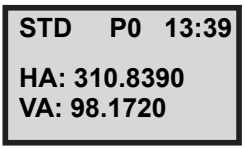
Key in the height of the volume. In this case we key in 10 and press ENT.



Here is the calculated volume. Press ENT to exit the program.

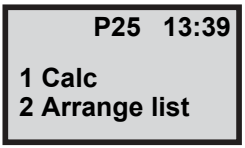


The Geodimeter is now in program 0 (P0).
Choose program 25 – Area Calc.



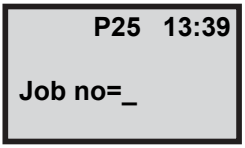
Here you can choose if you want to calculate the area in the order the points are measured (1 Calc) or if you want to

arrange the points in a different order and calculate that area. Here we choose 2 Arrange list.



2

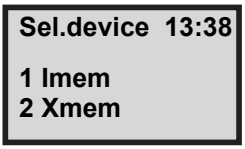
Key in the Job file in which the measured points are stored and press ENT.



ENT

Note – *Displayed if Job/Mem is switched on (MNU61)*

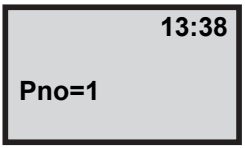
In which memory unit is the Job file located. In this example it is in the internal memory. Press 1.



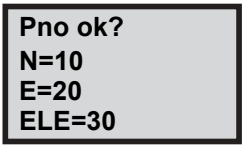
1

Note – *In Info 32 appears it may be that the Job file you have keyed in does not exist in the chosen memory unit or if you are using an external memory that the connections are bad. In Info 44 appears it may be that the Job file does not contain right point data.*

Key in the first point no in the area. The point must exist in your Job file. In this case we key in 1 and press ENT.

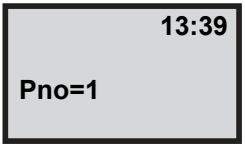


Here is the point coordinates displayed. Accept the point with YES or cancel with NO. Here we accept the point.

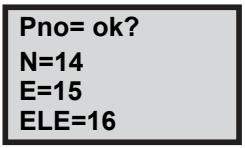


Note – *Only displayed if Confirmed is switched on (MNU 61)*

Key in the second point in the area. In this case we key in point no 4.

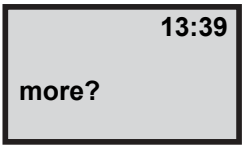


Accept the point coordinates with YES or cancel them with no.

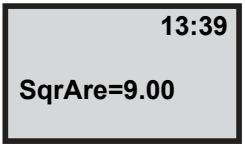


Note – *Only displayed if Confirmed is switched on (MNU 61)*

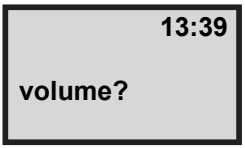
After having keyed in 3 points you have the chance to calculate the area. Press YES to continue key in more points or press NO to calculate the area.



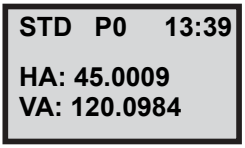
Here is the calculated area. Press ENT to continue.



Do you want to calculate the volume. Press YES to accept or NO to cancel. In this example we press NO.



You are now returned to program 0.



CHAPTER

9

P26 DistOb

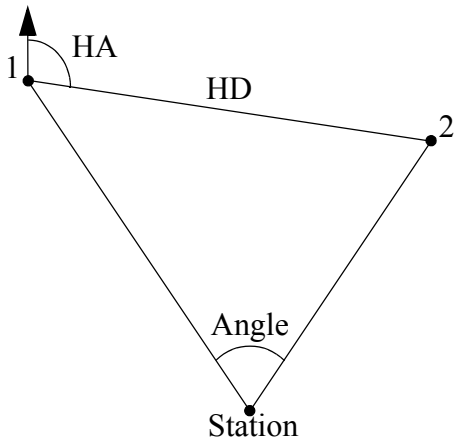
In General 9-2
How to use 9-4

In General

DistOb will allow you to calculate distances between objects even if the line of sight is obstructed. The program calculates the horizontal distance and the difference in height between two points. If the instrument is oriented in a coordinate system the true bearing (azimuth) between the two points will be calculated as well.

How do I work with DistOb

This is done simply by choosing the program 26. Select a Stn.point where you have a free line of sight to the two points between which you would like to measure the distance.

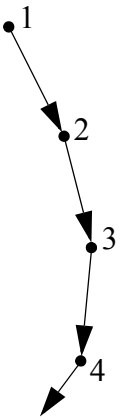


The result is given in the form of HA=bearing, HD=horizontal distance and DHT=difference in height between these two points.

The actual measuring can be made using two different combinations:

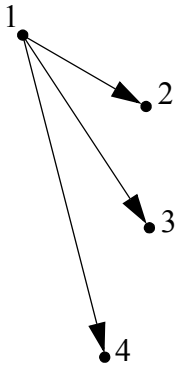
Combination 1

HA, HD and DHT are displayed as the measured and calculated result between point 1 to 2, 2 to 3 and so on.



Combination 2

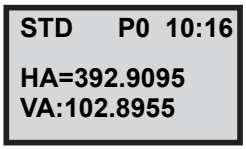
HA; HD and DHT are displayed as the measured and calculated result between point 1 to 2, 1 to 3 and so on.



How to use

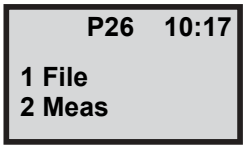
Switch on the instrument and go trough the Start procedure until the instrument is in theodolite mode.

The instrument´s station has been established. Select program 26 (DistOb).



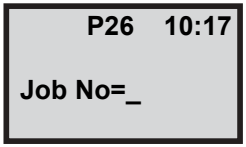
PRG 2 6 ENT

If you want to measure the distance between two object choose 2. Meas. If you want to calculate the distance between two points stored in the memory choose 1. File, see page 9-4.



2

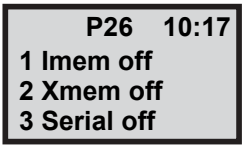
Key in the number of the Jobfile in which you want to store your bearing, distance and height.



ENT

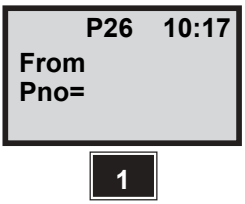
Note – *Displayed if Job/Mem is switched on (MNU61)*

You can activate which device you wish for the storage of the Job file by choosing the appropriate number 1, 2 or 3.



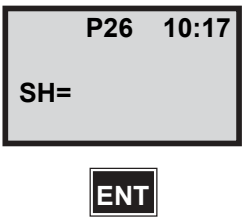
Note – *Only displayed if Job/Mem is switched on (MNU61)*

Select the first point your want to measure from. Key in e.g. 1 and press ENT.

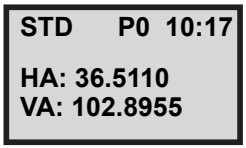


Note – *If you select a point that already has been measured in a previous task, this point will not be remeasured.*

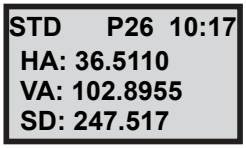
Key in the Signal Height and press ENT.



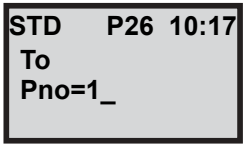
The instrument is in theodolite mode. Aim to the first point and press the A/M key.



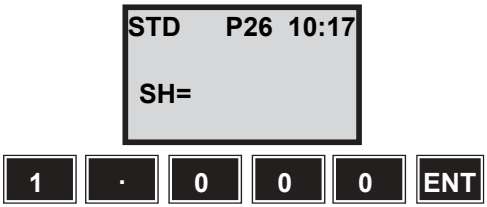
The instrument has now measured angle and distance to Pno=1. The values are ready for registration. Press REG.



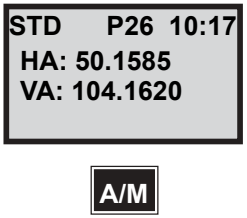
The program remembers the latest measured point. Choose the second point. Key in 2 and press ENT.



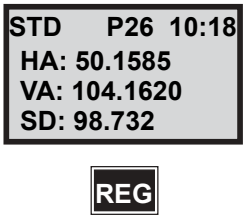
Key in the signal height. In this example we key in 1.000 and press ENT.



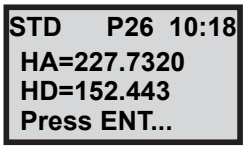
The instrument is in theodolite mode. Aim to the second point and press A/M.



The instrument has now measured angle and distance to Pno=2. The values are ready for registration. Press REG.

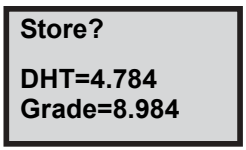


The result is calculated and displayed, press ENT to see more.



HA=Horizontal angle (Bearing)
HD=Horizontal distance

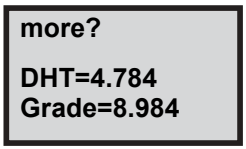
Press YES to store the results.



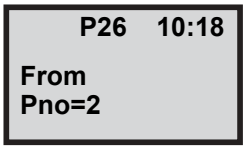
DHT=Difference in height.

Grade=Slope between the included points in percent (DHT/HD)

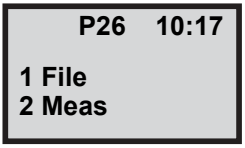
Do you want to continue press YES. Press NO to exit.



You are now able to continue with the next point.

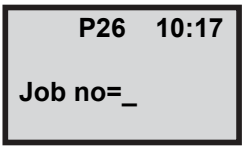


Choose 1 File.



1

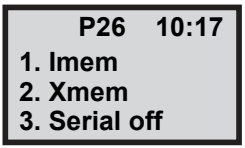
Key in the number of the Jobfile in which you want to store your bearing distance and height.



ENT

Note – *Displayed if Job/Mem is switched on (MNU61)*

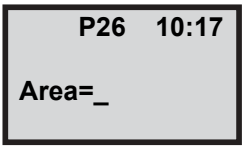
In which memory device do you want to store your Jobfile. Press ENT.



1 ENT

Note – *Only displayed if Job/Mem is switched on (MNU61)*

In which Areafile are your point coordinates stored. Key in the number press ENT.



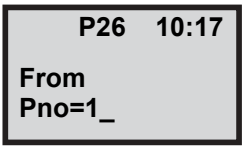
9

Note – *The points must have an elevation.*

In which memory device is the Areafile stored.

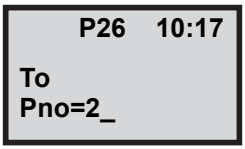
1

Select the first point in the calculation. Key in e.g. 1 and press ENT.



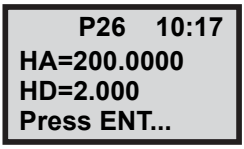
1

Select the second in the calculation. Key in e.g. 2 and press ENT.



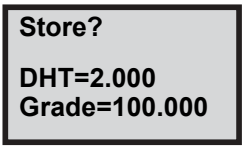
The result is calculated and shown in form of:

Press ENT to see more.



HA=Horizontal angle (Bearing)
HD=Horizontal distance

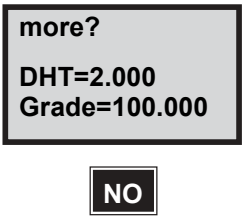
Press YES to store the results.



DHT=Difference in height.

Grade=Slope between the included points in percent (DHT/HD)

Do you want to continue press YES: Press NO to exit to P0.



CHAPTER

10

P27 Moving Coordinates Forward

In General 10-2

How to use 10-3

- Foresight Measurement 10-9
- Other Measurement 10-11
- Registered Data 10-19

In General

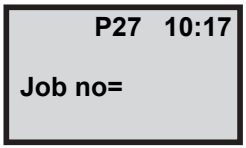
Moving coordinates forward is a program for moving coordinates forward from a known station.

Please note that no calculations will be performed, but the program will store everything in the memory for later PC processing.

How to use

PRG 2 7 ENT

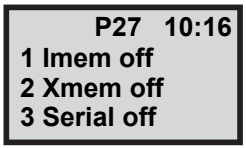
Here you key in the number or name of the job file in which you wish to store your traverse data. A list of data stored in the selected job file can be seen on page 10-19. select, for example, Job no = 2.



2 ENT

Note – *Displayed if Job/Mem is switched on (MNU61)*

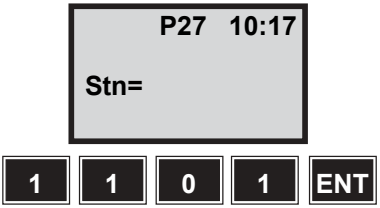
Where will you store your job file? Choose a suitable memory unit by indicating 1, 2 or 3 for activation/deactivation. Then press ENT. Here we have chosen to work with the internal memory.



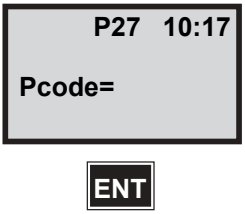
1 ENT

Note – *Only displayed if Job/Mem is switched on (MNU61)*

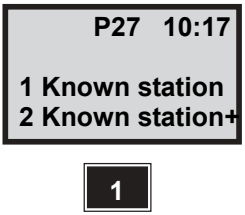
Key in your station number.



Here you have an opportunity to choose a Pcode for the station point. If you don't wish to have any Pcode leave the line blank and press ENT.



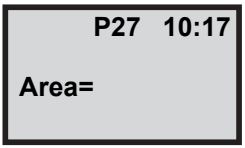
Here you select if you want to use "known station" with one reference object or "known station+" with more reference objects. In this example we'll chose "1 known station". Press 1.



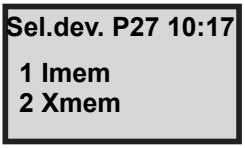
Note – *Known Station+ is described on page 3-15.*

Key in the name of the area file in which you have stored your station point and your reference object. If you leave

the line blank you are able to enter the coordinates manually. See *Enter the coordinates manually page 10-5.*



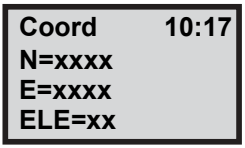
In which memory unit is your Area file stored? In our example, we are using the internal memory (Imem).



Enter the coordinates manually

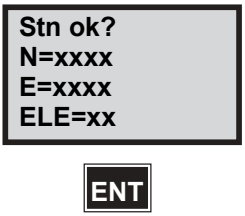
Enter your station coordinates. Leave the ELE blank for no height establishment.

Note – *If you left "Area=" blank you're taken here*

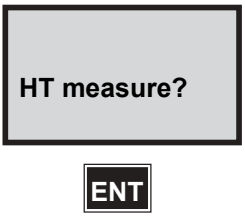


Are your coordinates correct? Press Yes (ENT) to accept them. If you press No you will return to the question about Stn= and Area=. If the coordinates have to be changed, use

Edit or P43 (Enter Coordinates). In this example we will continue by accepting them.

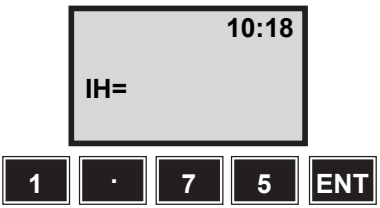


Are you going to measure Heights? Accept this question by pressing ENT (Yes). If you decide not to measure heights (Press No) it means that the instrument height (IH) and signal height (SH) will be ignored. In this example we will be measuring heights. Press ENT.



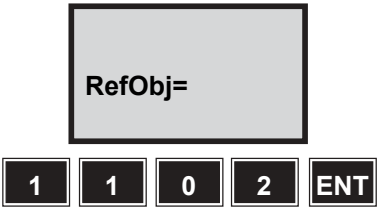
Note – *Only shown if your coordinates includes ELE*

Enter your instrument height (IH). For example, 1.75.

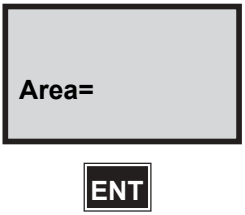


Note – *Only shown if your coordinates includes ELE*

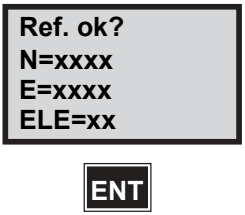
Key in the Pno of your reference object. For example, 1102.



Key in the name of the Area file in which you have stored your reference object. If you leave the line blank you will have the opportunity to enter the coordinates manually in the same way as for the station coordinates.



Are your coordinates correct? Press ENT to accept them. If you press No you return to the question Ref.Obj=. If they have to be changed, use Edit or P43 (Enter Coordinates). We will continue by accepting them.

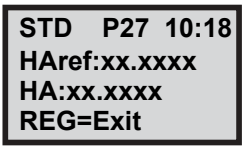


Note – *Only displayed if Confirmed is switched on (MNU 61)*

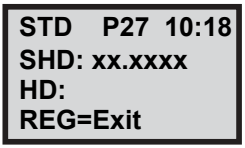
Aim at your reference object. Then press the A/M key.

HAref is the calculated bearing between the station point and the reference object.

If you wish to check the distance to the reference object, press ENT. Otherwise press REG to store the station establishment and exit.



If the reference object is marked with a reflector, you can also check the horizontal distance by pressing the A/M key. Otherwise press REG to store the station establishment and exit.



Here you can compare the calculated distances with the actual measured distance. Press REG to store station establishment in the Job file you have chosen.

```
STD   P27  10:19
SHD: xxx.xxx
HD: xxx.xxx
REG=Exit
```

REG

Note – *The REG key must always be used if you want to store the station establishment. Press REG to continue with Program 27.*

Foresight Measurement

Choose 1 Foresight.

See page 10-11 for other. Choose option 2 Refobj. If you wish to measure more angles. (Not first shot!)

```
        P27  10:19
1 Foresight
2 Refobj.
3 Other
```

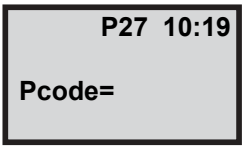
1

Key in the foresight point number.

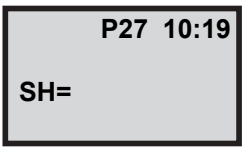
```
              10:19

Pno=
```

2 ENT

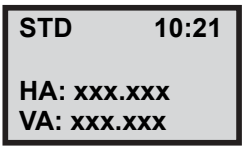
Here you have the opportunity to choose a Pcode for the foresight point. If you don't wish to have a Pcode leave the line blank and press ENT.



Enter the signal height.



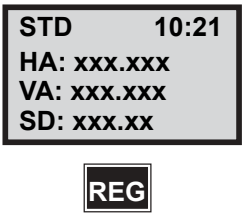
The instrument is now in theodolite position and is ready to measure. Aim at the chosen target. Press the A/M key to measure the distance.



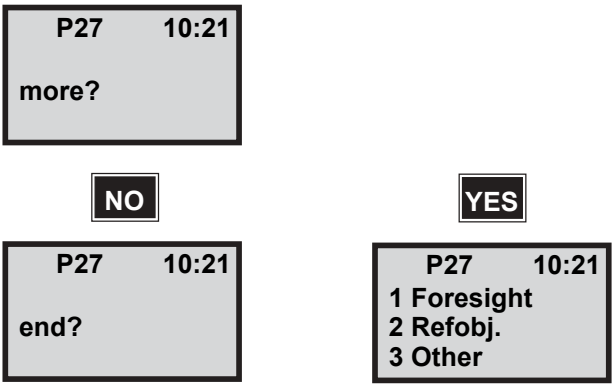
Note – *It is possible to measure in all modes STD, FSTD, TRK, D-bar) and in both faces.*

The instrument displays HA, VA and SD for your first point. Your measurement can now be registered. Press the REG key.

See page 10-20 for a list of what is stored in the memory.



Do you wish to measure more points press YES. Press NO to exit the program. Answer NO to the question "End" if you're not finished.

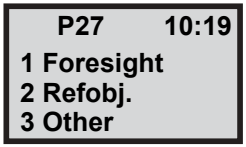


Note – *If "NO", see page 10-16.*

Other Measurement

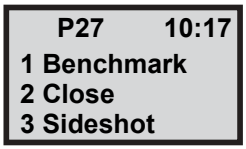
Choose 3 Other

See page 10-9 for Foresight.



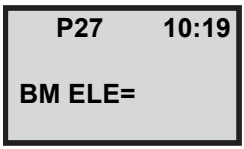
3

Choose measuring mode.



Note – *The available menu choices below does not perform any calculations, but will only store information in memory for later computer processing.*

If you choose: 1



ENT

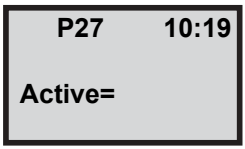
Enter the benchmark elevation for the point

See page 10-11

If you choose: 2

See below

If you choose: 3

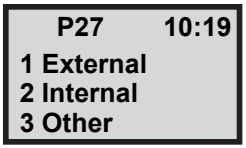


ENT

Enter the activity code for the sideshot

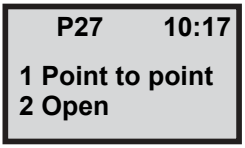
See page 10-11

Choose the method to close the traverse.



If you choose:

3

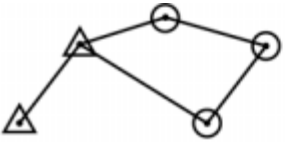


See next page

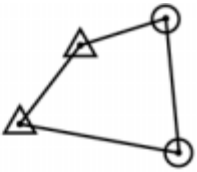
If you choose:

1 or 2

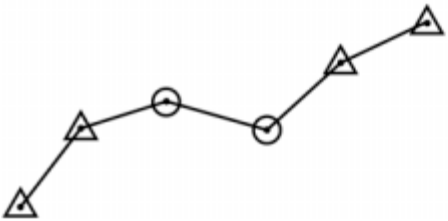
See next page



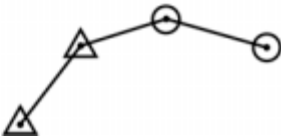
Close External (CE)



Close Internal (CI)

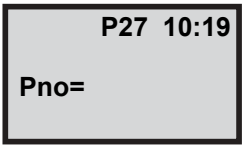


Point to point (P)



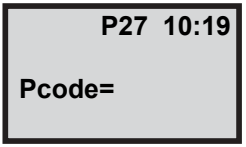
Open (O)

Enter the point number.



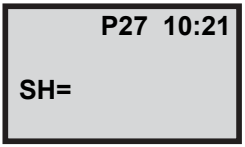
2 ENT

Here you have the opportunity to choose a Pcode for the point. If you don't wish to have any Pcode leave the line blank and press ENT.

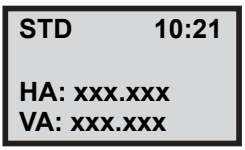


ENT

Enter the signal height.



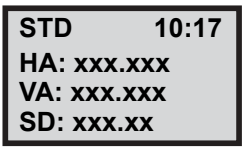
The instrument is now in theodolite position and is ready to measure. Aim at the chosen target. Press the A/M key to measure the distance.



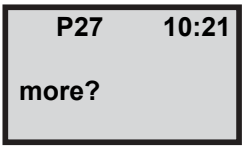
Note – *It is possible to measure in all modes (STD, FSTD, TRK, D-bar) and in both faces.*

The instrument displays HA, VA and SD for your first point. Your measurement can now be registered. Press the REG key.

See page 10-19 for a list of what is stored in the memory

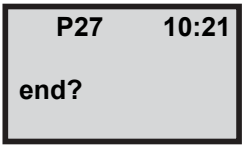


Do you wish to measure more points press YES. Press NO to exit the program. Answer NO to the question "End" if you're not finished.



NO

Note – *If you choose YES see next step.*



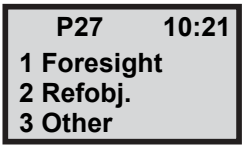
NO

Note – *This question will not appear if you have chosen to close*

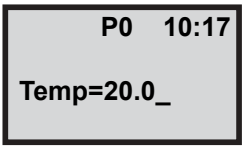
If you wish to re-measure a foresight point press 1. You will then get an info message "Info 55" and a question "New foresight".

Press 3 to measure other points.

YES



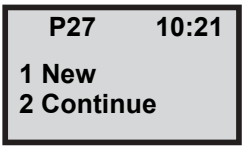
The instrument returns to program 0. See next page for instructions of how to start the program on the next station.



Start program 27

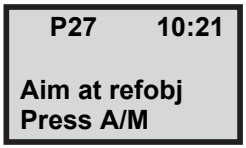
PRG 2 7 ENT

Choose 1 if you wish to start a new or choose 2 if you wish to continue with the old.



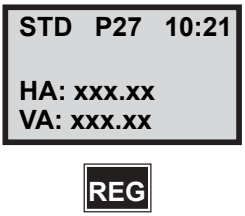
2

Aim at your reference object and press A/M.



A/M

Press A/M and REG if distance is to be measured, otherwise press only REG



Registered Data

Job file		Comments
First Station data using one reference object		
Text	**Label**	**Description**
Activity OS	61	Station data
Pno (STN)	5	
Pcode	4	Stored if entered
IH	3	Stored if heights are included
Coordinates	37,38,39	39 if heights are included
Activity RO	61	Reference object data
Pno (Ref.Obj)	5	
Coordinates	37,38,39	39 if heights are included
HA_ref	21	(Set HA)
Raw data	7,8,(9)	Stored if distance is measured
First Station data using more than one reference object		
Text	**Label**	**Description**
Stn	2	Point number for station
Coordinates	37,38,39	39 if heights are included
Pno (STN)	5	First point
SH	(6)	
Coordinates	37,38,39	39 if heights are included
Raw data	7,8,(9)	Polar data
Pno		Like first point
.		
Info, Weighting	0	
Info, Diff HA	0	
Info, Point list	0	
Pno	5	First point
(dHD)	(76)	Deviation from true HD
dHA	45	
Pno		Like first point
.		
Activity OS	61	Occupied Station

Job file		Comments
Pno (STN)	5	
Pcode	4	
IH	3	
Coordinates	37,38,39	
Activity RO	61	Reference Object
Pno Blank	5	no number
Coordinates, 0.000	37,38,(39)	Values = 0.000
HA_ref	21	Instrument direction when exiting Station Establishment
Raw data	7,8,(9)	
Next Station		
Text	**Label**	**Description**
Activity OS	61	Station data
Pno (STN)	5	
Pcode	4	Stored if entered
IH	3	Stored if heights are included
N (STN)	37	
E (STN)	38	
ELE (STN)	39	Stored if heights are included
Activity RO	61	Reference object data
Pno (Ref. Obj)	5	
Pcode	4	Stored if entered
SH	6	Stored if heights are included
N (RO)	37	
E (RO)	38	
ELE (RO)	39	Stored if heights are included
HA_ref	21	Stored if distance is not measured
HA	7	
VA	8	
SD	9	Stored if distance is measured
HAII	17	Stored if measured in two faces (STD, D-bar)
VAII	18	Stored if measured in two faces (D-bar)

Job file		Comments
HAI	24	-"-
VAI	25	
Foresight		
Text	**Label**	**Description**
Activity FS	61	Foresight data
Pno	5	
Pcode	4	Stored if entered
SH	6	Stored if heights are measured
N	37	
E	38	
ELE	39	Stored if heights are measured
HA	7	
VA	8	
SD	9	
HAII	17	Stored if measured in two faces (STD, D-bar)
VAII	18	
HAI	24	Stored if measured in two faces (D-bar)
VAI	25	-"-
Benchmark, Sideshot, Close		
Text	**Label**	**Description**
Activity *	61	
Pno	5	
Pcode	4	Stored if entered
SH	6	Stored if heights are measured
BM ELE	31	Store if BM ELE has been chosen
N	37	
E	38	
ELE	39	Stored if heights are measured
HA	7	
VA	8	
SD	9	

Job file		Comments
HAII	17	Stored if measured in two faces (STD, D-bar)
VAII	18	Stored if measured in two faces (D-bar)
HAI	24	-"-
VAI	25	* Activity codes: Sideshot = optional Benchmark =BM Close: External = CE Internal = CI Point to point = P Open = O

Refobj.

Text	Label	Description
Activity RO	61	Reference object data
Pno	5	
Pcode	4	Stored if entered
SH	6	Stored if heights are measured
N	37	
E	38	
ELE	39	Stored if heights are measured
HA	7	
VA	8	
SD	9	Stored if distance is measured
HAII	17	Stored if measured in two faces (STD, D-bar)
VAII	18	
HAI	24	Stored if measured in two faces (D-bar)
VAI	25	-"-

CHAPTER

11

P28 Obstructed Point

In General 11-2
How to use 11-3

In General

Obstructed Point is a program which will help you to measure towards obstructed points.

The method simplifies the measuring task since the range pole does not have to be held in a levelled position. Mount two prisms on a range pole. Locate the pole on the difficult point and measure towards each prism. The program will then calculate the position of the difficult point.To get the best result locate the prism B a close as possible to the obstructed point, C. The highest accuracy of the measurement is also achieved if the distance between prism A and B, dist AB, is as large a possible. See figure 11.13.

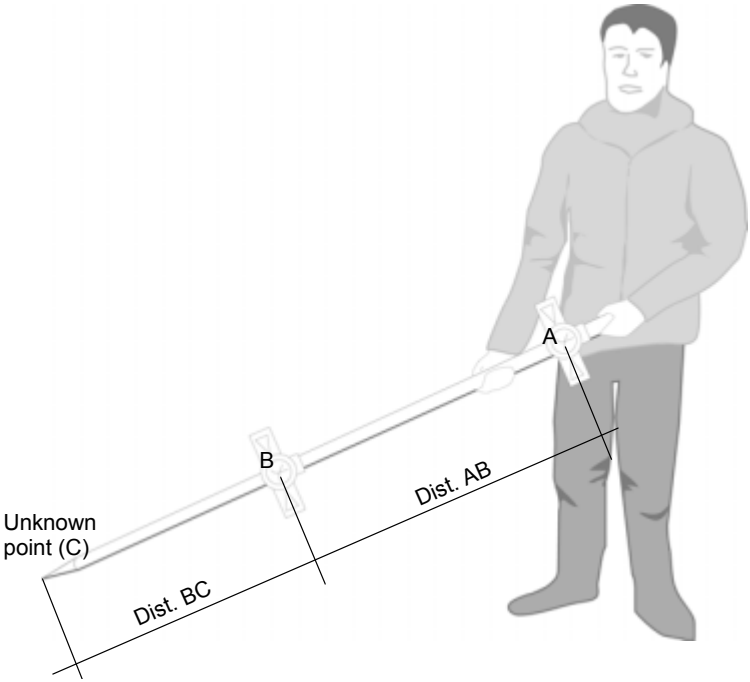


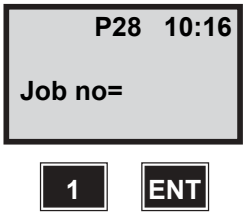
Figure 11.13 Distance definitions.

How to use

Mount two prisms on a range pole and note the distance BC, see figure 11.13 on page 11-2 The distance between the two prisms will be calculated and does not have to be entered. Locate the pole on the obstructed point (it is not necessary to hold the pole in a levelled position).

Select program 28 (Obstructed Point).

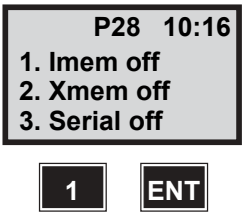
Key in the number or name of the Job file in which you which to store data about your measurements. A list of data stored in the selected Job File can be seen on page page 11-9.



Note – *Displayed if Job/Mem is switched on (MNU61)*

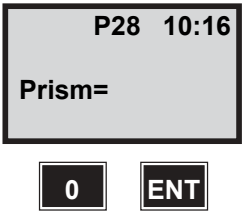
Choose in which memory unit you wish to store your Job file. Activate/deactivate a memory unit by pressing its

corresponding key number and ENT. In this example we choose 1, Imem.

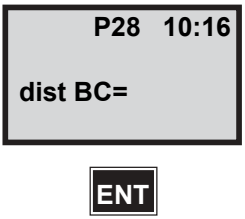


Note – *Only displayed if Job/Mem is switched on (MNU61)*

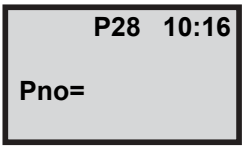
Enter the prism offset and press ENT.



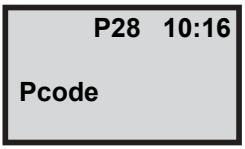
Enter the distance BC, that is the distance between prism B and the obstructed point C: See page 11-2. figure 11.13.



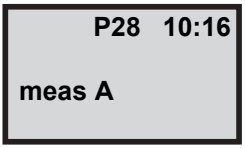
Enter a point number for the point to be measured and press ENT.



Here you have an opportunity to enter a Pcode for the point. The program will propose the last Pcode entered. Accept it, key in a now or leave it blank for no Pcode. If you leave it blank this question will not appear for the next point.

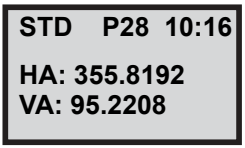


Start with measuring towards the first prism, A, and press ENT.

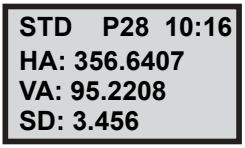


Note – *If your have a signal from the prism you can start the measurement at this point by pressing A/M.*

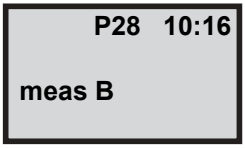
Aim towards the first prism, A, and press the A/M-key to start measurement.



Press REG to register the first measurement.



Continue with measuring towards the second prism, B and press ENT.



Note – *If you have a signal from the prism you can start the measurement at this point by pressing A/M.*

Aim towards the second prism, B, and press the A/M-key to start measurement.

```
STD   P28  10:17

HA: 355.8192
VA: 94.1760
```

A/M

Press REG to register the second measurement.

```
STD   P28  10:17
HA: 355.8193
VA: 94.1800
SD: 3.586
```

REG

These are the coordinates for the obstructed point. Press ENT to see more data for the point or press REG to store the point and continue with a new measurement.

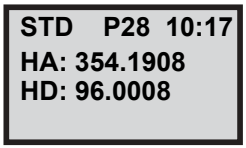
```
STD   P28  10:17
N: 2890.987
E: 1098.879
ELE: 222.098
```

ENT

Note – *Skip point. If you press CL the following display appear and you are able to skip the point and continue with a new point:*

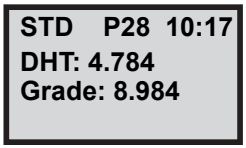
```
STD   P28 10:17
Skip point?
```

Press ENT to see more or press REG to store the point and continue with a new measurement.



HA=Horizontal Angle (Bearing)
HD=Horizontal Distance

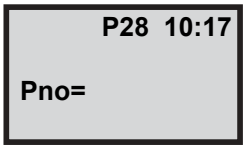
Note – *Skip point. Press CL to skip the point and continue with a new point.*



Press ENT to see the coordinates for the point or press REG to store the point and continue with a new measurement.

Press CL to skip the point and continue with a new point.

The program automatically increments the point number. Accept it, enter a new value or press PRG 0 to exit to program 0.



Job file in Imem	Comments
Prism offset	Stored before the first measurement
distance BC	
User defined data, pnt A	
User defined data, pnt B	
Activity code	Calculated data follows
Data for the obstructed point (C)	
Pno	
Pcode	Stored if it has been entered
N	
E	
ELE	
HA	
HD	
DHT	
Grade	

Figure 11.14 List of data stored in the selected Jobfile.

CHAPTER

12

P29 RoadLine

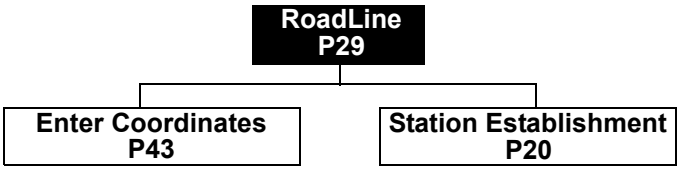
In General 12-2
- Structure 12-3
- Store 12-3
- Check 12-5
- Set Out 12-5
- Measure 12-6

How to use 12-9
- P29 - 1. Store 12-9
- P29 - 2. Check 12-14
- P29 - 3. Set Out 12-16
- P29 - 4. Measure 12-30

In General

RoaldLine is a program for setting out road/rail lines. It is easy to use and contains routines for registering section interval, centre offsets, section (=”chainage” in some countries or “station” in USA), coordinates and different types of road/rail elements. The program also contains check/control function which ensures that the stored element parameters are correct. Two methods can be used while setting out; 1. Conventional radial setting out and 2. Orthogonal or rectangular setting out. At key in of section interval (longitudal section) and iptional centreline offset (-=Left, + =Right), the program automatically converts the setting out point coordinate values to setting out data i.e. Horizontal distance and Bearing.

The program covers intergrated use of following programs:



Structure

Roadline comprises 4 main functions:

Store

For registration of the start and end coordinates of the different elements.

Check

For mathematical check of the stored element coordinates and parameters.

Set Out

For setting out points along roadline both centreline and offset, plus station establishment (Known or Free Station).

Measure

For measuring in existing roadline elements, both centreline and offset, and objects that may lie along the roadline.

Store

With this function in the RoadLine program you store all roadline data, i.e. section interval, centre line offset, section. Start and end coordinates of the different roadline elements and type of element. A roadline can contain 3 types of elements:

- **Straight**
- **Circular Arc**
- **Transition**

Roadline data is stored in the form of section, start and end points of the element and the type of element, i.e. straight, arc or transition. This data is then either stored in the internal memory of the instrument or in Geodat.

When storing circular arc and transition elements, radius and A-parameter must also be stored. While storing transition curves instead of keying in the A-parameter, the option to store Radius and length is open ($A= \overline{R \times l}$). In this case, at the prompt "Radius", key in the RxL factor, at the prompt "Length" key in – 1 or 1 which is the direction of the curve (-=Left, no sign=Right).

When storing roadline data, you must ensure that the following combinations **do not occur** in the data produced by your road design program:

- **Transition- Transition-Transition**
- **Straight-Transition-Transition**
- **Transition-Transition-Straight**
- **Straight-Transition-Straight**

In order to overcome the problems concerning the mathematical solutions of any of the above combinations, they can be overcome by defining a radius at the different elements connecting points, i.e. by defining a straight or arc element and placing it between the elements in question. These "pseudo elements" need only have a longitudal length of a few millimetres, which will not effect the accuracy of the eventual setting out of the points which lie along those elements. In the case of the first combination, store it with this combination instead:

- **Transition-Straight-Transition-Straight-Transition**

Check

This function mathematically checks the stored coordinates and curve parameters of the different elements after registration of the data in an Area file. All errors in excess of 20 mm are displayed and the element in which they are. Errors which occur due to wrongly keyed in In-Data can be easily rectified with the help of Edit (MNU2).

Note – *A detected error can depend on either key in errors or incorrect design of the roadline.*

Set Out

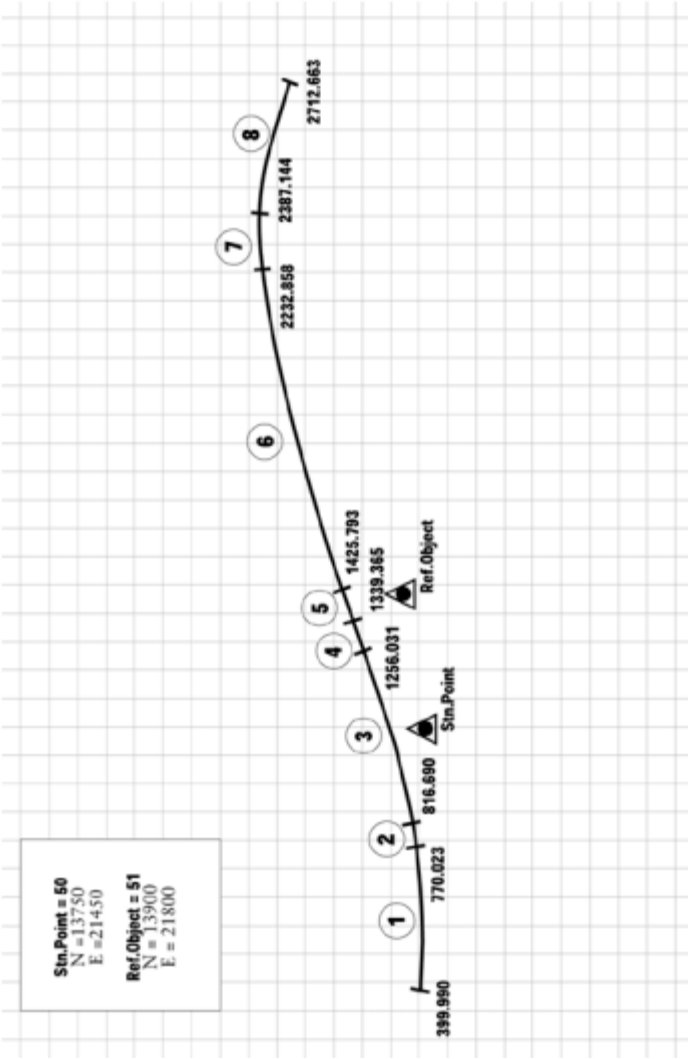
Before any setting out task can be commenced, it is necessary of course to inform the Geodimeter CU of the position at which the instrument is set up. Program 29 contains Station establishment.

Setting out task

After establishment and orientation of your survey station, registration of section interval and centre line offset is carried out (if it has not already been done with the STORE, option file). Directly thereafter the setting out data in the form of horizontal bearing and horizontal distance to the setting out point are calculated. If cross section data is available for each or some sections, 3 dimensional setting out of cross sections can be executed. In this case questions regarding (HT-measure?) in the station establishment program must be answered with YES.

Measure

The option Measure enables the operator to localize the section and centre line relative to a stored roadline. You simply measure an arbitrary point and the program calculates the section/centre line offset and coordinates of the point. This part of the program is especially suitable for cross-sectioning or localizing an obstacle when checking a planned section of road.


Stn.Point = 50
N = 13750
E = 21450
Ref.Object = 51
N = 13900
E = 21800
1
2
3
4
5
6
7
8
399.990
770.023
816.690
1256.031
1339.365
1425.793
2232.858
2387.144
2712.663
Stn.Point
Ref.Object

Roadline example

This table is used in the following examples.

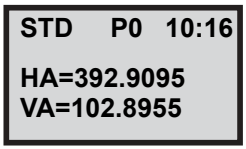
Element no.	Section	Northing	Easting	Type	Radius /A-par
	399.990	13751,63	20872,790		
1				circle	-1400
	770.023	13766,681	21241,440		
2				clothoid	-350
	816.690	13775,341	21287,294		
3				circle	-3000
	1256.031	13892,688	21710,267		
4				clothoid	-500
	13339.365	13921,506	21788,458		
5				clothoid	+550
	1452.793	13951,437	21869,538		
6				circle	+3500
	2232.858	14135,099	22653,592		
7				clothoid	+400
	2387.144	14145,571	22807,429		
8				circle	+800
	2712.663	14079,093	23123,798		
9				clothoid	+300
	2825.163	14029,418	23224,709		
10				clothoid	-300
	2937.663	13979,743	23325,621		
11				circle	-800
	3175.785	13918,354	23554,785		
12				clothoid	-300
	3288.285	13910,932	23667,015		
13				straight	-
	3297.592	13910,536	23676,313		

How to use

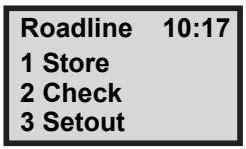
Before beginning to use RoadLine in the field we recommend that you run trough the program in the office. Switch on the instrument, and disengage the dual-axis compensator with function 22 and step through program 0 by pressing only ENT until you place instrument in the theodolite mode.

P29 - 1. Store

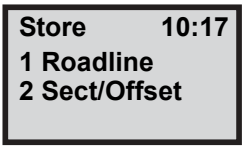
The instrument´s station has been established. Select program 29 (RoadLine).



Now you can choose between the four main functions. Let us start to store roadline data. Press 1.



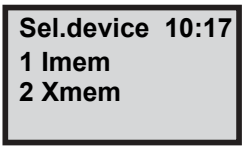
At this stage you are able to select if you want to store the Section incrementation and Offset, but this can also be done in Setout. Let us select Roadline. Press 1.



1

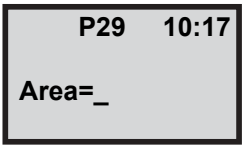
Note – *In this case the offset and incrementation values will not be saved when you exit the program.*

This is a display of the memory devices available. Let us select in which device we shall store our roadline data e.g. Imem (Internal Memory). Press 1.



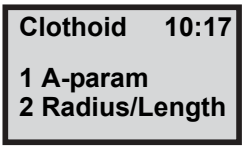
1

Key in the name of the Area file in which you wish to store the Section No., Coordinates and type of elements and press ENT.

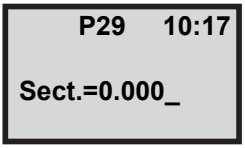


ENT

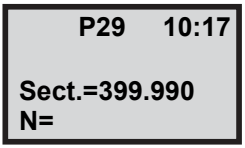
This is a switch key, you can choose if you want to store A-param or if you want to store Radius and Length. In this case we choose 1.



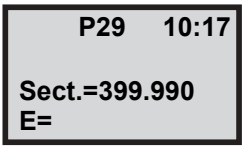
Key in the first Section No. for the roadline. In this example we key in 399.990 and ENT.



Key in the Northing value of section No. 399.990. In this example it is 13751.63.

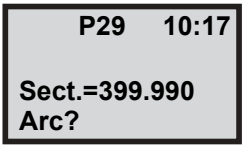


Key in the Easting value of section No. 399.990. In this example it is 20872.790.



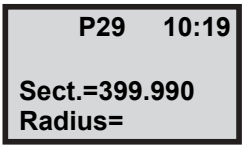
ENT

Select type of roadline element, Straight, Arc or Roadline end by pressing NO until the correct element type is displayed. Accept the type by answering YES. In this example we choose ARC.



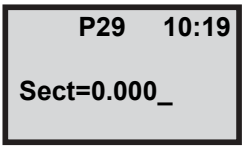
YES

Key in the radial dimension, in our example-1400. After you have pressed ENT, a beep signal will be heard. The roadline data for section 399.990 are now stored in Area file 100.

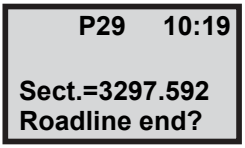


ENT

Key in the next section point and repeat the above instructions. In this example we key in 770.023 and ENT.

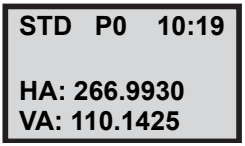


When you are selecting the last roadline element, select Roadline end. Roadline end=YES, means that the last element will be stored as a straight line.



Note – *The last element must be a straight line.*

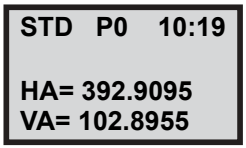
You are now returned to the program P0.



You have now stored all roadline data in Area file 100, the stored data are; the different types of roadline elements, section no. and coordinates. Now it´s time to check the keying in and geometrical solutions of the different roadline elements with the help of function CHECK.

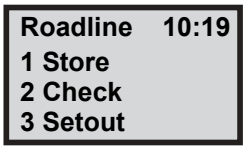
P29 - 2. Check

Choose program 29.



PRG | 2 | 9 | ENT

Let us select the control function CHECK. Press 2.

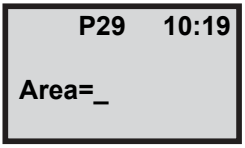


2

Select in which device roadline data is stored. In this example it is in the internal memory.

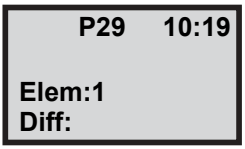
1

Key in the name of the Area file you wish to check.



ENT

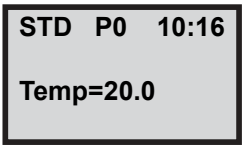
The program check each element stored in Area file.



ENT

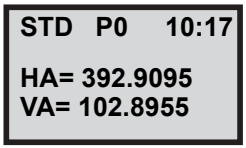
Note – *A comparison with the total longitudinal centre line measurement of each individual section is carried out. If the final result gives an error message, one or more elements contain errors in which curve length errors are 20mm. Re-check the roadline and define the element with an error. The element can be changed with EDIT (MNU 2).*

After have gone through CHECK the instrument returns to program P0.

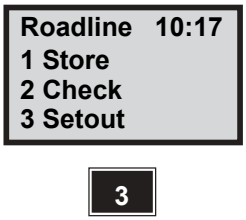


P29 - 3. Set Out

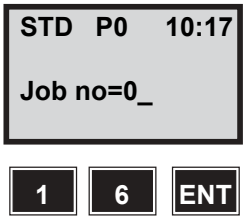
Choose program 29.



Let us select start the setting out. Press 3.



Key in the number of the Job file in which you want to store the set out point coordinate deviations.



Note – *Displayed if Job/Mem is switched on (MNU61)*

Storage of Control Data

The coordinate deviations will represent the differences between stored set out point coordinates and the actual set out point coordinates. This is the basis of the printed out

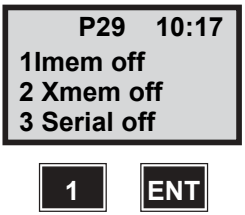
data sheet which will act as proof of having carried out your setting out task to within the contract specified accuracy.

These dN, dE and dELE deviations are also much easier to use than comparing actual set out values with their respective theoretical values. If you don't want to store any control data, clear the suggested Job no, and press ENT. Control data that will be stored are:

```
Pno=Section/Offset
dN=
dE=
dELE=
```

If height measurement is carried out also elevation is stored (staked Elevation). If you wish to store other control data you can Configure the user defined output table.

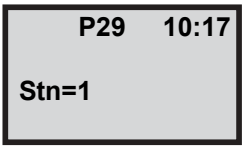
Here you can activate which device you wish for storage of the Job file by choosing the appropriate number. Here we choose the internal memory. Press 1 and ENT.



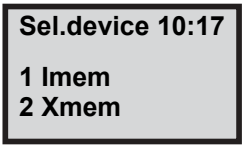
Note – *Only displayed if Job/Mem is switched on (MNU61)*

Is "1" your station? As station establishment was done prior to P29, this station will be proposed now. If no station establishment has been made, P29 will automatically propose establishment of a known or free station (that is, P20 Station Establishment) when you press ENT. In this

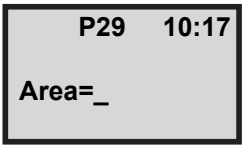
example we will continue by accepting the suggested station. Press ENT.



Choose the type of device in which the roadline data is stored. In this example we have stored the roadline data in Imem Area 100. Press 1.

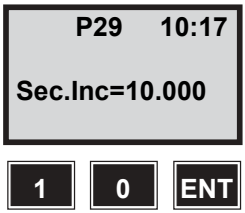


Key in the Area file number in which the roadline data I stored and press ENT.

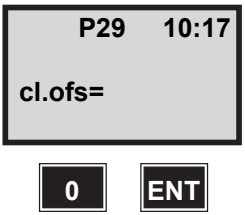


Here you are able to select which Sec.Inc. you shall have in this roadline example. If you already have stored Sec. Inc.

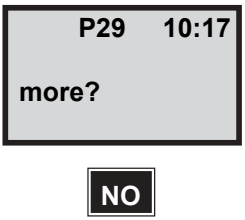
in “Store”, the program selects that value. Let us select Sec.Inc.=10m. Press 10 and ENT.



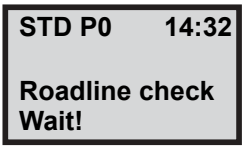
Now you are able to store the centre line offset.
” 0 ” =centreline.



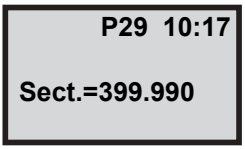
Answer YES to this question if you have more values to store, in our example- 5m, -10m to the left and 5m, 10m to the right. When all offset values are stored answer NO to the question.



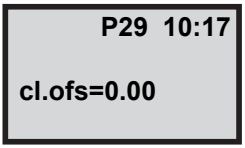
The program checks that the element combinations, shown on page 12-3 do not occur. Wait!



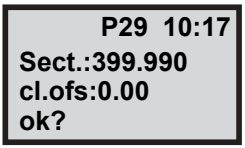
The program suggests the first section in the Area file, but can easily be changed to any value. In this example we accept the value, press ENT.



The program is presenting the centreline for the first section, if ok press ENT, otherwise you will have the opportunity to select another offset value. Press ENT.

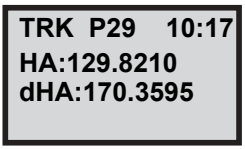


Is the setting out data for the first section ok. Press YES. The instrument adopts the TRACKING mode automatically

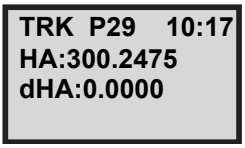


The countdown zero method

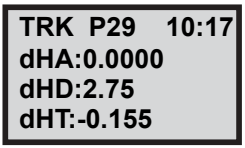
The instrument should be rotated to the right + 170.3595 degrees. - =Left, + = Right. This is called the count down to zero angle method. See page 12-21 for the radial/right angle method.



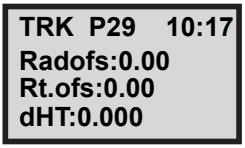
When the instrument displays approx. 0.0000 opposite dHA, it is pointing in the direction of the first section point. HA is the calculated bearing to the first section point.



As soon as the prism comes within the measurement beam you will see dHD=remaining. In this case the prism is on line but the distance has to be increased by 2.75m.



When the radial offset, right angle offset and dHT are 0.00, the correct lateral set out position and height have been set out.



Measurement tip

When using the count down to zero as your setting out method, it is convenient to decrease the number of decimals in the Label 77=dHA. This can be done via menu 13.

Note – *If you during the setting out will have difficulties in being able to set out the point, the program will give you a opportunity to skip it. Just press Reg and the question "Skip Point?" will be displayed. Answer YES to this question and the program will continue with the next setting out point.*

When you press REG, these are the three values which are stored in the Imem, i.e. deviations from the correct set out point coordinates. Press REG to record deviations or ENT

to see coord. of the set out point. In this example we press ENT.

```
TRK  P29    10:18
dN:0.00
dE:0.00
dELE:0.000
```

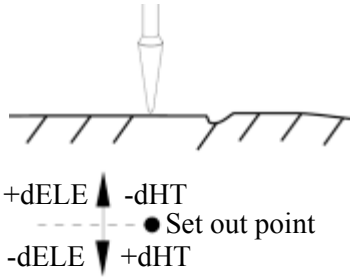
ENT

Note – *Rotate the instrument with servo!*

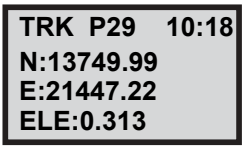
If you press without measured distance ELE=the height at the theoretical set out point.

If you press with measured distance ELE=the height at the measured set out point.

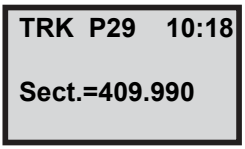
If you press longer than 1 sec. with measured distance ELE=the height at the theoretical set out point.



These are the actual coordinates of the set out point´s present position. Press REG to store the deviations seen on the previous page.

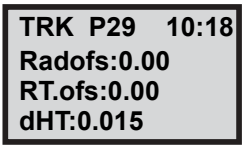


The program suggests the next section stored in Area file. Key in the section number and centreline offset you want to work with and repeat the above instructions.



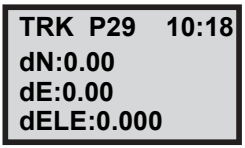
Radial/Right angle offset method

When you have a radial and right angle offset of 0.00 the correct lateral set out position has been found, i.e. N&E only.



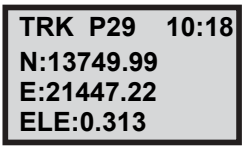
ENT

When you press REG, these are the three values which are stored in the Imem, i.e. deviations from the correct set out point coordinates. Press REG to record deviations from the correct set out point coordinates. Press REG to record deviations or ENT to see coord. of the set out point.In this example we press ENT.



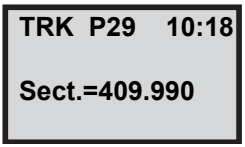
ENT

These are the actual coordinates of the set out point´s present position. Press REG to store the deviations seen on the previous page.



REG

The program suggests the next section. Key in the section number and centreline offset you want to work with and repeat the above instructions.

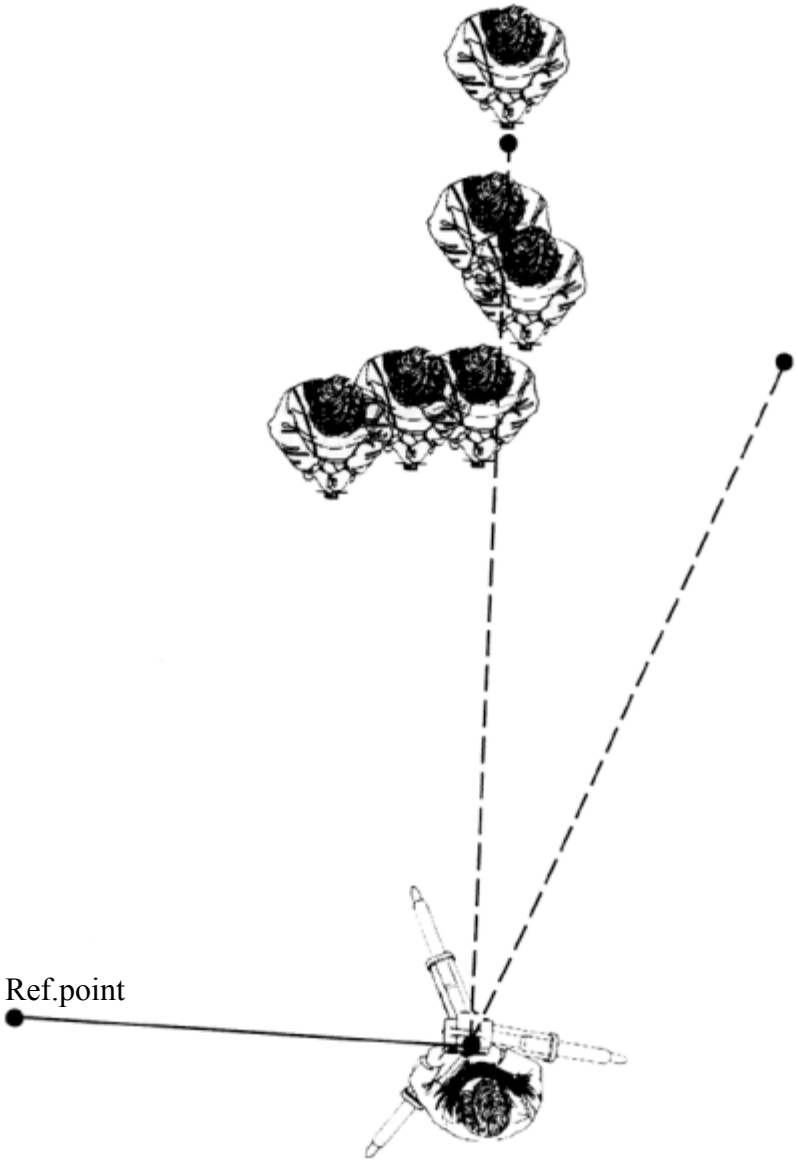


How to combine countdown to zero and radial/right angle offset for setting out

In order to benefit most from the inherent intelligence of your Geodimeter CU, we recommend that you try to combine the two different setting out methods, previously described. Here below is an example of how we combine the countdown to zero method with the radial and right angle offset method.

1. If the setting out data for the first section is ok, press YES and the instrument will automatically adopt the TRACKING mode. The display will show the calculated bearing, Hz, and the dHA.
2. Rotate the instrument until the display shows approx. DHA=0.0000.
3. The instrument is now pointing in the direction of the first setting out point.
4. Guide the prism bearer on line with help of the tracklight®.
5. As soon as the prism comes within the measurement beam, you will see dHD=remaining distance to your set out point.
6. By pressing ENT at this stage, you are also able to see the radial and right angle offset to the point. When

Radofs.=0.0000 and RT.ofs.=0.0000, the correct lateral set out position is reached.


Ref.point

Height Setting Out

If cross section data is available for each or some sections, 3 dimensional setting out of cross sections can be executed. The following must be true:

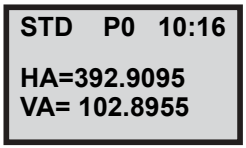
1. It is assumed that elevation exists in your Stn. Coordinates.
2. The question height measurement “HT=?” comes up in the program 20 Station Establishment.
3. If YES, “IH=?” (Instrument Height) appears automatically.
4. The question “SH=?” (Signal Height) appears when you enter the setting out part of the program. If you are going to use R.O.E (Remote Object Elevation) we recommend that you key in SH=0.
5. After given section interval and centreline offset the question “SHT” appears. Key in the information given in your cross section.

Measurement tip

If you would like to set out the height e.g. at +1.0m, add 1.0m to your instrument height and use R.O.E. When dHT=0 you are pointing 1.0m above finished construction level.

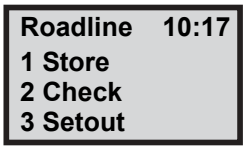
P29 - 4. Measure

Choose program 29.



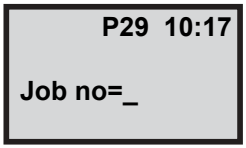
PRG 2 9 ENT

Let us select start the measuring. Press 4.



4

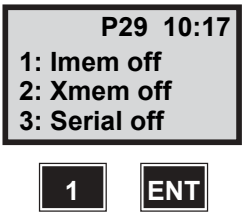
Key in the number of the Job file in which you want to store the measured point coordinate deviations.



ENT

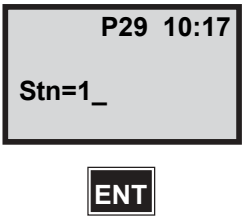
Note – *Displayed if Job/Mem is switched on (MNU61)*

In which memory device to you want to store the Job file. In this case we choose 1 the internal memory and Press ENT.



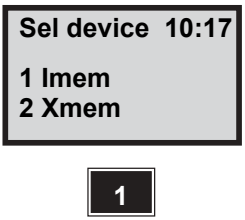
Note – *Only displayed if Job/Mem is switched on (MNU61)*

Is “1” your station? As station establishment was done prior to P29, this station will be proposed now. If no station establishment has bees made, P29 will automatically propose establishment when you press ENT.

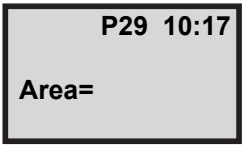


Note – *Only displayed if Stn is switched on (MNU61)*

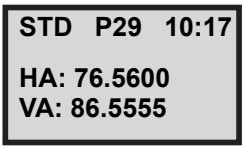
Choose in what type of device in the roadline data is stored. In this example we have stored the roadline data in Imem.



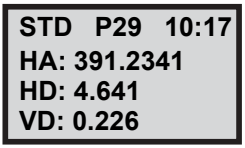
In which area file are the roadline data stored?



The instrument is now in theodolite mode. Aim at the first point and press A/M to start measurement.

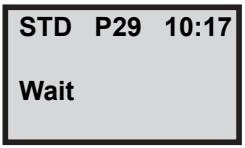


Press the REG key to check the points location according to the roadline.

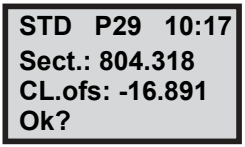


The program checks if the point lays close to any of the roadline sections. If no section is found INFO 32 will

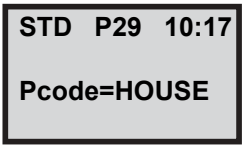
appear. The maximum distance between the point to measure and the nearest roadline section is 1.000m.



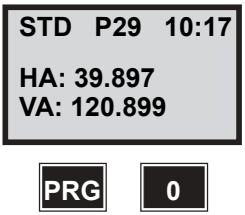
The point lays 16.891 meters from roadline section 804.318. If this is ok press YES. If you answer NO the program will check if the point lays close to any other section.



Here you have the opportunity to choose a Pcode for the measured point. If you leave the line blank no Pcode will be stored and the question will not appear for the next point.



The program is now in theodolite mode. If you want to exit the program to program 0 press the program key and then 0.



CHAPTER

13

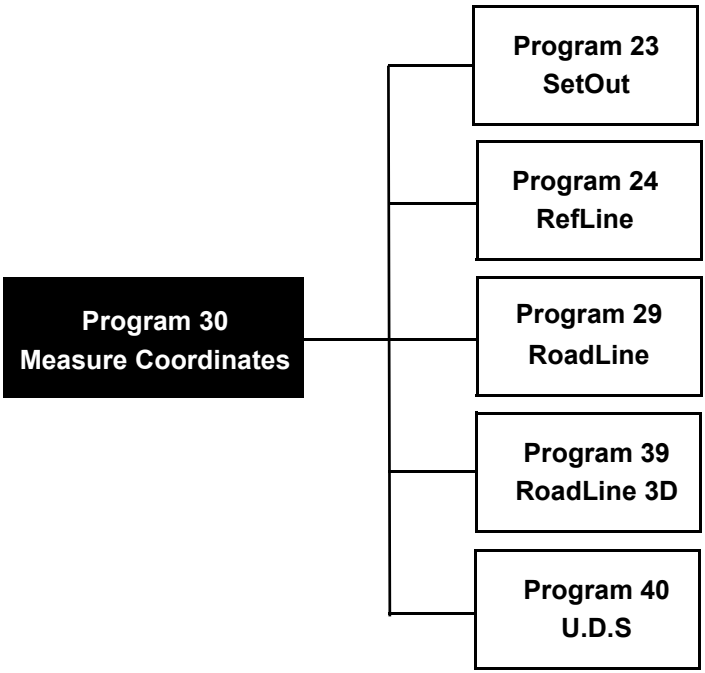
P30 Measure Coordinates

In General 13-2
How to use 13-3

In General

With Program 30, Measure Coordinates, you can measure and store your coordinates directly to an Area file, i.e you don't have to store the coordinates in a Job file and then transfer them to an Area file. The coordinates can then be used for new station establishments.

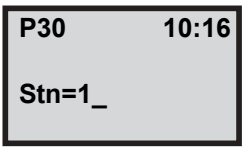
Program 30 is included in the following programs:



How to use

Assuming that Station Establishment has been carried out at your station point press PRG 30 and ENT to start program 30.

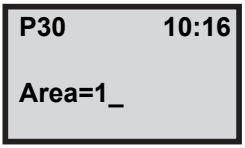
The text "Measure Coord" will briefly show on the display and then your Stn number is shown. Press ENT.



Note – *Only displayed if Stn is switched on (MNU61)*

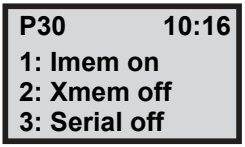
Note – *If the station hasn't been established you're taken to Program 20, Station Establishment.*

Enter the name of the Area file in which you want to store your coordinates.

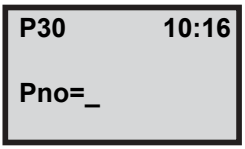


Choose what memory unit you'll use. Toggle between on and off by pressing the corresponding numeric key.

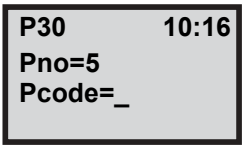
Confirm with ENT.



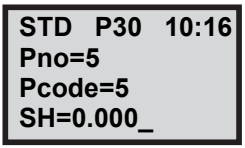
Enter the number of the point to be measured.
Confirm with ENT.



Enter a Pcode and press ENT.



Enter the signal height for the point to be measured and press ENT.



Note – *Only shown if heights are used.*

Aim towards the point to be measured and press A/M.

```
P30          10:16*
HA: 123.4567
VA: 98.7654
```

A/M

Note – *It is possible to choose any measurement mode: STD, TRK or D-bar, one or two-face.*

The coordinates for your measured point are shown in the display. Press REG to store them in the selected Area file.

```
STD  P30  10:16*
N: 1887910.683
E: 3950613.782
ELE: 111.125
```

REG

Note – *Only shown if heights are used.*

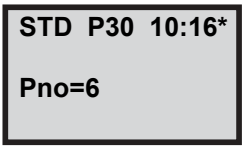
Do you want to measure and register more points? In this example we will measure one more point. Press ENT.

```
STD  P30  10:16*

more?
```

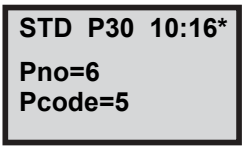
ENT

Enter the number of the point to be measured. (Pno is automatically incremented by 1 for each new point. You can, however, choose whatever number you want).

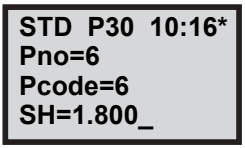
Confirm with ENT.



Enter a Pcode for the new point and press ENT. (The previously used Pcode is shown default. You have to change this manually). We choose 6 in this example. Press 6 and ENT.



Enter the signal height for the point to be measured and press ENT. (The previously used SH is shown default).



Note – *Only shown if heights are used*

Aim towards the new point to be measured and press A/M.

```
STD  P30  10:16*
HA: 234.5678
VA: 88.7654
```

A/M

Note – *It is possible to choose any measurement mode: STD, TRK or D-bar, one or two-face.*

The coordinates for your second point are shown in the display. Press REG to store them in the selected Area file.

```
STD  P30  10:16*
N: 1887832.876
E: 3950413.456
ELE: 89.125
```

REG

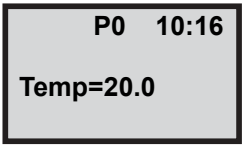
Note – *Only shown if heights are used*

Do you want to measure and register more points? In this example we are satisfied with two points. Press NO.

```
STD  P30  10:16

more?
```

NO

You are now taken to P0.



Here are the data that can be stored in the Area file you have chosen.

Area File	Label No.
Stn	2
Stn Coordinates	37,38,(39)
RefObj	62
RefObj Coords	37,38,(39)
HA_ref*	21
HD	11
IH	3
Info, measured point	0
Pno	5
Pcode	4
SH	6
Raw data	7, 8, 9
Measured Coords	37,38,(39)
Next Pno	5
.	4
.	6
.	7, 8, 9
.	37,38,(39)
.	.

* HA_ref for Known Station = calculated and Set HA, HA_ref for Free Station and Known Station+ = Current instrument direction when exiting P20.

CHAPTER

14

P32 Angle Measurement Plus

In General 14-2
Configuration 14-3
How to use 14-5

In General

With Angle Meas Plus you can measure multiple rounds of angles, with automatic calculation of "station mean values". The measured angles will be reduced to a final result where you can get a standard deviation for the sightings. You can also configure your own limits for horizontal and vertical angle errors.

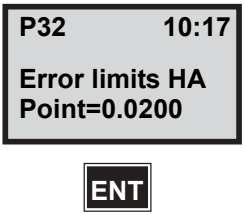
It is possible to choose between manual or automatic aiming towards the targets to measure. In the latter case you'll need a Remote Target (RMT) at every point to measuring.

In automatic mode you can choose to get the slope distance also in C2.

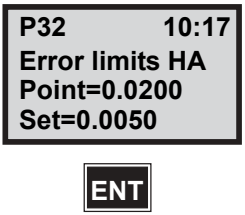
Configuration

To speed up the program you can configure it so it fits your needs. The configuration part can be accessed by a long press on the PRG-key. Then choose program 32, Angle Meas Plus and press ENT. Choose option 2, Config and then 2 Options.

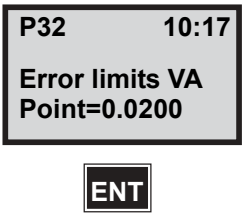
If you get a deviation larger than this value the program will show an error message. This error limit is only to make sure that you measure towards the correct target.



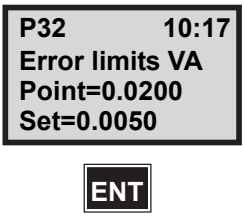
One set= one measurement towards one point i both faces. If you get a difference between two sets that is larger than this value the program will show an error message.



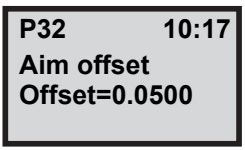
If you get a deviation larger than this value the program will show an error message. This error limit is only to make sure that you measure towards the correct target.



One set= one measurement towards one point i both faces. If you get a difference between two sets that is larger than this value the program will show an error message.



This tells how much the instrument will point aside the point to measure, in order to force the user to do the fine adjustment when using a servo driven instrument.



Finally choose Exit and then Exit again to quit or Run to start the program.

How to use

Select program 32 and press ENT.

PRG 3 2 ENT

First you will step through a number of switches that you can configure. If you wish to change a switch, press the corresponding number and ENT, otherwise press only ENT.

```
Switches  10:17
1 Elevation? Yes
2 Pcode? Yes
3 Sightings>1 No
```

ENT

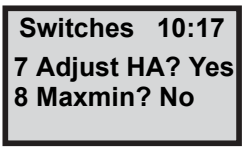
1. To get questions about IH and SH.
2. Set a point code for each point.
3. Enable this if you wish to do more than one adjustment towards each point in a set.
4. Store Horizontal and Vertical distances instead of SD. (Not possible if you want to measure a distance in CII, Automatic mode.)
5. Enable this if you want the instrument to automatically switch to face 1 between each set. If you wish to run automatic mode this must be enabled.

```
Switches  10:17
4 Reg HD/VD No
5 Set-transit? Yes
6 Aim offset Yes
```

ENT

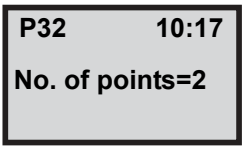
6. Enable this if you want the instrument to point beside each point so that you can do the fine adjustment yourself (only servo).

7. Enable this if you want a new horizontal angle for every set according to the formula 200 grads (180°)/no of series.

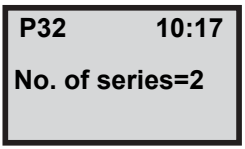


8. Enable this if you want to get the difference between the highest and lowest measured value. In other case you will get the standard deviation.

Enter the number of points (2-10) in the set and press ENT.

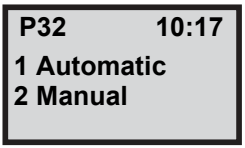


Key in the number of repeated measurements you wish to perform and press ENT.



Choose 1 Automatic and you'll only have to aim once at the target, then the program will automatically switch face and perform the number of remeasurements you set.

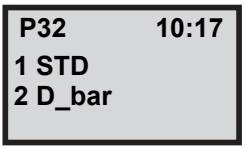
In this case we will choose 2 Manual.



2

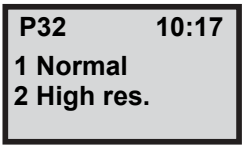
See page 14-19 for 1 Automatic

Choose which mode you wish to measure in, STD or D-bar.



2

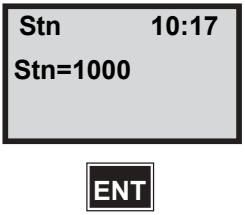
Select normal or high resolution, in this case we will select normal.



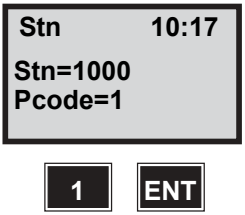
1

Note – *This display will only appear if you have a Trimble 5601.*

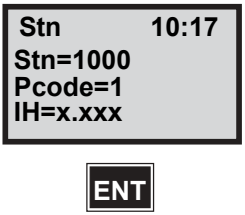
Enter the station number and press ENT.



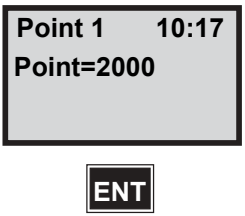
Enter a point code for the station and press ENT.



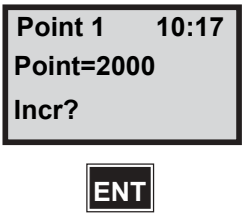
Enter an instrument height and press enter.



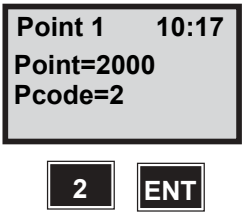
Key in a name for the first point and press ENT.



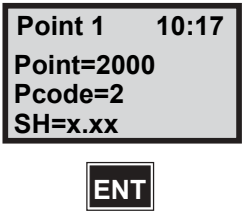
Do you wish to increment the point number for each new point, press YES or ENT, otherwise press NO.



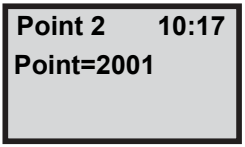
Here you have the opportunity to choose a Pcode for the first point. If you don't wish to have any Pcode leave the line blank and press ENT.



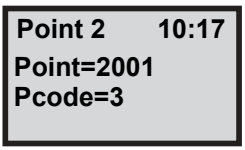
Key in the signal height for the first point and press ENT.



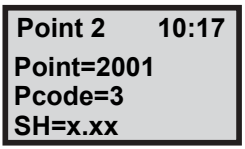
Key in a name for the second point and press ENT.



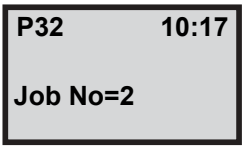
Here you have the opportunity to choose a Pcode for the second point. If you don't wish to have any Pcode leave the line blank and press ENT.



Key in the signal height for the second point and press ENT.

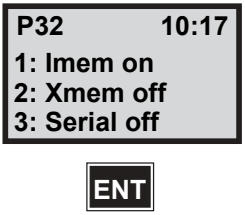


Choose in which Job file you wish to store your angle measurements and press ENT.



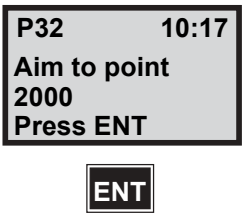
Note – *Displayed if Job/Mem is switched on (MNU61)*

Here you select which memory device you wish to store the Job file in by choosing the appropriate number and pressing ENT.

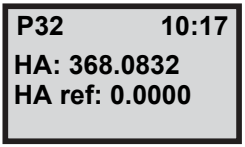


Note – *Only displayed if Job/Mem is switched on (MNU61)*

Make a coarse aiming towards the first point and press ENT.



Key in a starting (first) reference angle and press ENT.



Note – *This will only appear if you have answered YES to AdjustHA in the menu Switches.*

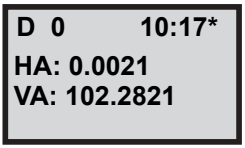
Do the fine adjustment towards the point and press A/M to measure or REG to store without measuring.

In the second case you will be prompted the following:

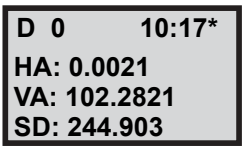
No meas. made

REG OK?

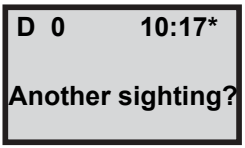
Press YES or ENT to accept or NO to cancel.



This is the first sighting towards point 2000 in face 1. Press REG to store the measurement.

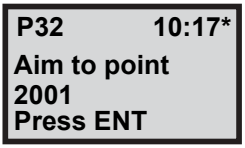


If you have enabled switch no 3 this display will appear. Press YES or ENT to make another sighting or NO to cancel.



NO

Make a coarse aiming towards the second point and press ENT.



ENT

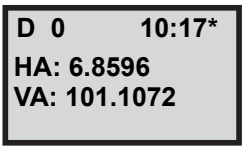
Do the fine adjustment towards the point and press A/M to measure or REG to store without measuring.

In the second case you will be prompted the following:

No meas. made

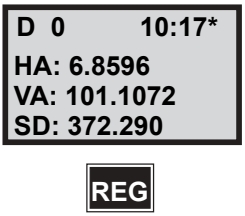
REG OK?

Press YES or ENT to accept or NO to cancel.



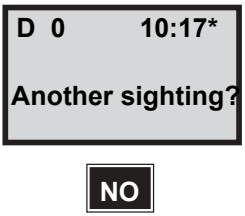
A/M

This is the first sighting towards point 2001 in face 1. Press REG to store the measurement.

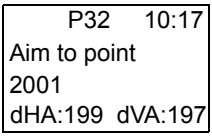


If you have enabled switch no 3 this display will appear. Press YES or ENT to make another sighting or NO to cancel.

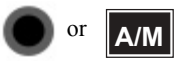
Switch to face 2 (automatic if you have a servo instrument).



The following display appears if you have a mechanical instrument (disappears when you get within 1grads of the point):



Aim towards the second point 2001 in face 2 and press the A/M key on the back of the instrument.



Aim towards the first point 2000 in face 2 and press the A/M key on the back of the instrument.

or **A/M**

If switch no 5 is enabled the instrument will automatically switch to face no 1 (servo only).

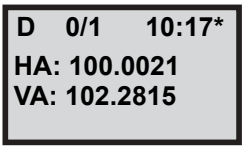
Press A/M to measure or REG to store without measuring.

In the second case you will be prompted the following:

No meas. made

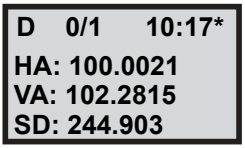
REG OK?

Press YES or ENT to accept or NO to cancel.



A/M

This is the second measurement towards point 2000 in face 1. Press REG to store the measurement.



REG

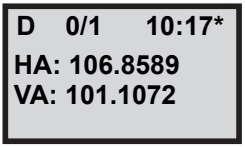
Press A/M to measure or REG to store without measuring.

In the second case you will be prompted the following:

No meas. made

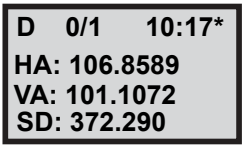
REG OK?

Press YES or ENT to accept or NO to cancel.

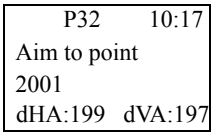


This is the second measurement towards point 2001 in face no 1 (servo only). Press REG to store the measurement.

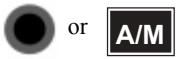
Switch to face 2 (automatic if you have a servo instrument).



The following display appears if you have a mechanical instrument (disappears when you get within 1 grads of the point):



Aim towards the second point 2001 in face 2 and press the A/M key on the back of the instrument.



Aim towards the first point 2000 in face 2 and press the A/M key on the back of the instrument.

or **A/M**

If switch no 5 is enabled the instrument will automatically switch to face no 1 (servo only).

Here are the differences for the first point (if you have 3 or more points this will be presented as standard deviations, or max/min value if switch 8 is activated). If you wish to view all the deviations press YES or ENT, otherwise press NO. When running the program you will get an error message as soon as the program discovers a difference larger than the limits you have set.

Point 1 10:17*
Diff HA: 0.0011
Diff VA: 0.0004
Diff SD: 0.000

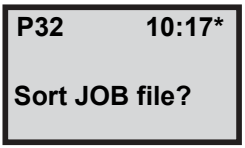
ENT

Here are the differences for the second point. Press ENT to continue.

Point 2 10:17*
Diff HA: 0.0010
Diff VA: 0.0004
Diff SD: 0.000

ENT

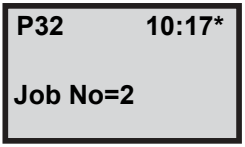
Do you wish to sort the measured data point wise in the chosen Job-file, press YES or ENT, otherwise press NO.



ENT

Note – *A final reduction will automatically be stored in the Job file.*

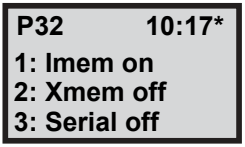
Choose a Job file to store the sorted data in.



ENT

Note – *Displayed if Job/Mem is switched on (MNU61)*

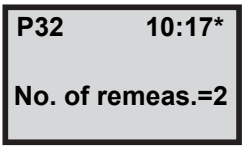
Here you select which memory device you wish to store the Job file in by choosing the appropriate number and pressing ENT.



ENT

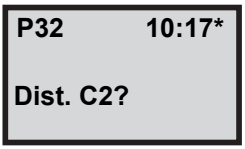
Note – *In this mode you'll need at least one Remote Target.*

Enter the number of remeasurements that will be carried out if the measured values are outside the limits specified in the configuration part of the program (see page 14-3) or if the target is temporarily hidden.



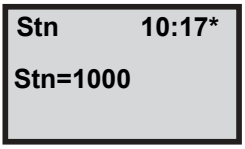
ENT

Do you wish to get the distance measured in C2? If so press YES or ENT.



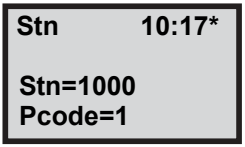
ENT

Enter the station number and press ENT.



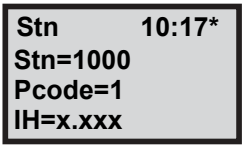
ENT

Enter a point code for the station and press ENT.



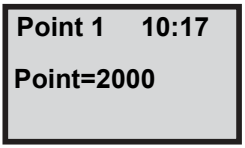
1 ENT

Enter an instrument height and press enter.



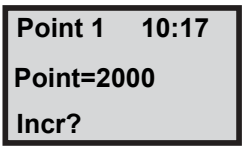
ENT

Key in a name for the first point and press ENT.



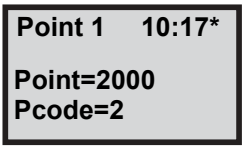
ENT

Do you wish to increment the point number for each new point, press YES or ENT, otherwise press NO.

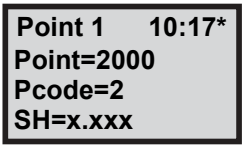


ENT

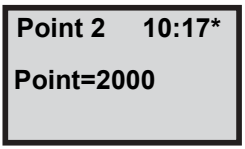
Here you have the opportunity to choose a Pcode for the first point. If you don't wish to have any Pcode leave the line blank and press ENT.



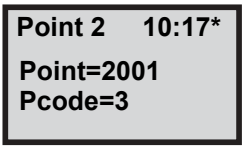
Key in the signal height for the first point and press ENT.



Key in a name for the second point and press ENT.

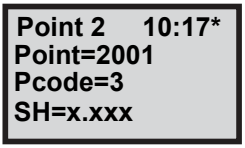


Here you have the opportunity to choose a Pcode for the second point. If you don't wish to have any Pcode leave the line blank and press ENT.



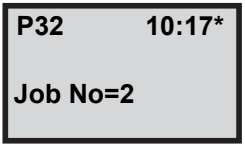
3 **ENT**

Key in the signal height for the second point and press ENT.



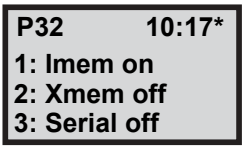
ENT

Choose in which Job file you wish to store your angle measurements and press ENT.

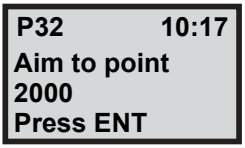


ENT

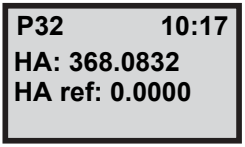
Here you select which memory device you wish to store the Job file in by choosing the appropriate number and pressing ENT.



Make a coarse aiming towards the first point and press ENT.

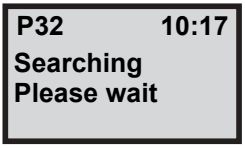


Key in a starting (first) reference angle and press ENT.

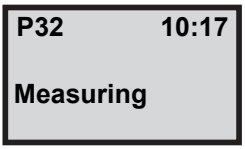


Note – *This will only appear if you have answered YES to AdjustHA in the menu Switches.*

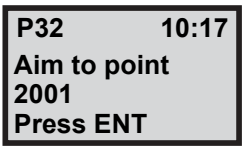
The instrument is searching for the target.



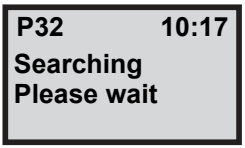
When target is found the instrument starts the measurement.



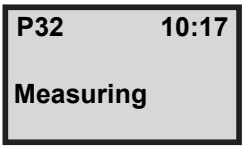
Make a coarse aiming towards the second point and press ENT.



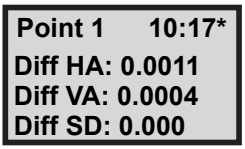
The instrument is searching for the target.



When target is found the instrument starts the measurement.

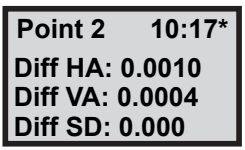


Here are the resulting differences for the first point. When running the program you will get an error message as soon as the program discovers a difference larger than the limits you have set.



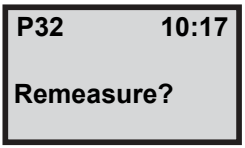
ENT

Here are the resulting differences for the second point. Press ENT to continue.

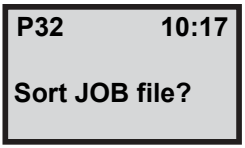


ENT

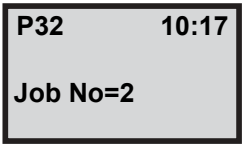
Press YES or ENT to remeasure and the program will automatically remeasure all targets.



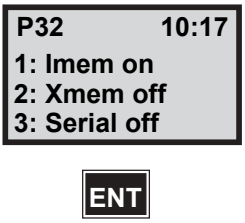
Do you wish to sort the measured data point wise in the chosen Job-file, press YES or ENT, otherwise press NO.



Choose a Job file to store the sorted data in.



Here you select which memory device you wish to store the Job file in by choosing the appropriate number and pressing ENT.



Registered data

Text	Label	Text	Label
Job No	50=32	SH	6=1.526
Stn No	2=1000	HA	7=6.8600
Pcode	4=1	VA	8=101.1069
IH	3=1.573	SD	9=372.2900
Pno	5=2000	Info	0=S_devHA:0.0010
Pcode	4=2	Info	0=S_devVA:0.0004
SH	6=1.453	Info	0=S_devSD:0.0000
HA	7=0.0021	Info	0=REDUCED
VA	8=102.2819	Pno	5=2000
SD	9=244.9033	Pcode	4=2
Pno	5=2001	SH	6=1.453
Pcode	4=2	HA	7=0.0000
SH	6=1.526	VA	8=102.2814
HA	7=6.8596	Pno	5=2001
VA	8=101.1070	Pcode	4=2
SD	9=372.2901	SH	6=1.526
Pno	5=2001	HA	7=6.8572
HAII	17=206.8614	VA	8=101.1069
VAII	18=298.8936	SD	9=372.2900
SD*	9=180.9999	Info	0=SORTED
Pno	5=2000	Pno	5=2000
HAII	17=200.0037	Pcode	4=2
VAII	18=297.7190	SH	6=1.453
SD*	9=120.1256	HA	7=0.0021
Pno	5=2000	VA	8=102.2819
HA	7=100.0016	SD	9=244.9033
VA	8=102.2813	HAII	17=200.0037
SD	9=244.9033	VAII	18=297.7190
Pno	5=2001	SD*	9=201.8769
HA	7=106.8588	HA	7=100.0016
VA	8=101.1071	VA	8=102.2813
SD	9=372.2900	SD	9=244.9033
Pno	5=2001	HAII	17=300.0037
HAII	17=306.8603	VAII	18=297.7183
VAII	18=298.8926	SD*	9=201.8876
SD*	9=111.0009	Pno	5=2001
Pno	5=2000	Pcode	4=2
HAII	17=300.0037	SH	6=1.526
VAII	18=297.7183	HA	7=6.8596
SD*	9=145.9997	VA	8=101.1070
Info	0=RESULT	SD	9=372.2901
Pno	5=2000	HAII	17=206.8614
Pcode	4=2	VAII	18=298.8936
SH	6=1.453	SD*	9=300.4655
HA	7=0.0028	HA	7=106.8588
VA	8=102.2814	VA	8=101.1071
SD	9=244.9033	SD	9=372.2900
Info	0=S_devHA:0.0011	HAII	17=306.8603
Info	0=S_devVA:0.0004	VAII	18=298.8926
Info	0=S_devSD:0.0000	SD*	9=344.8777
Pno	5=2001	* only in Automatic	
Pcode	4=2	mode if Distance C2	
»»»»»»»»»»	»»»»»»»»»»	is chosen.	

CHAPTER

15

P33 Robotic Lite

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How to use 15-4

In General

Robotic Lite is a program for collecting large amounts of data for volume calculations, terrain models or hydro graphic applications.

With Robotic Lite you can collect data as a single user. The only requirements are that you have a servo instrument with a tracker and a remote measuring target (RMT). The instrument will follow the RMT and store data with preset intervals. These can either be in form of the time between measurements or the time you have held the RMT still.

The program is divided in two parts:

1. Time & Dist

Enter a time, e.g. 10 seconds and a distance, e.g. 2 meters and the instruments will register data every 10th second, under the condition that you have moved not less than 2 meters from the last point of registration.

2. Stop & Go

Enter a time, e.g. 2 seconds and a distance, e.g. 2 meters and the instrument will register data when you have moved more than two meters under the condition that you have held your target still for not less than 2 seconds.

A useful function in Stop&Go is that the tracklight is automatically switched on when the program is initiated and starts flashing. When a registration is made the flash stops for 2 seconds and you get a confirmation that the registration is done when the flash starts again.

Automatic Search

If the instrument loses contact with the remote target, it will automatically start searching for the target until it regains contact and locks on to it.

Default Settings

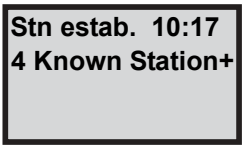
When the program is started it will automatically set the instrument in the following modes:

- tracking
- auto centring
- auto search

How to use

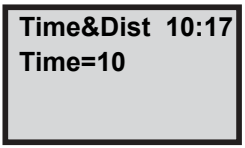
Select program 33 and press ENT.

Here you can perform station establishment if you wish. In this case we choose not to and press 1 Ok.

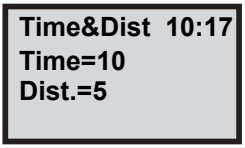


Choose between 1 Time&Dist and 2 Stop & Go.
In this case we will choose 1 Time & Dist.

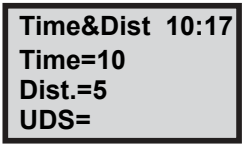
Enter the time interval that must have passed since the last registration in order to get a new registration.



Enter the distance that you must have moved since the last registration in order to get a new registration.

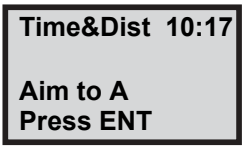


Enter the UDS you wish to use for your measurement.

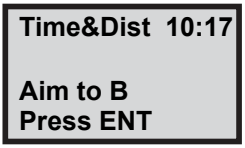


Now you are ready to set a search sector.

Aim the instrument towards the first sector limit and press ENT.



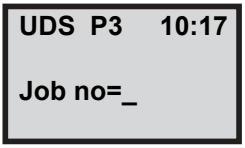
Aim the instrument towards the second sector limit and press ENT.



The sector will automatically be centred if you loose contact with the RMT.

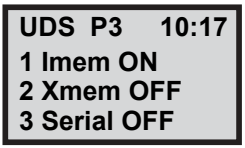
Note – *This is only an example UDS.*

Key in the Job file in which you wish to store the registrations.



Note – *Displayed if Job/Mem is switched on (MNU61)*

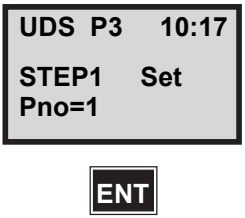
Select in which memory unit you wish to store the data and press ENT. In this case we select 1 Imem.



Note – *Only displayed if Job/Mem is switched on (MNU61)*

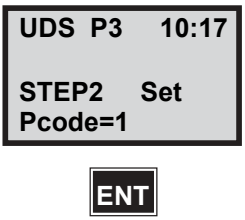
This is the first step in the example UDS. Enter the first Point number and press ENT.

Set Pno in Auto Incr./Decr.



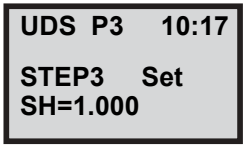
Enter a Pcode for the first point and press ENT.

Set Pcode in Auto Dup.

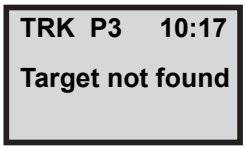


Enter the signal height for the first point and press ENT.

Set SH in Auto Dup.



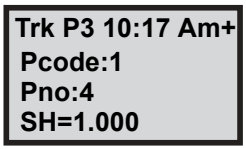
Aim to a point where you want to start the measurement. Walk to the point and the instrument will automatically lock on to the RMT and starts to follow.



As soon as the target is found and the first registration is performed you can see the information in the display.

You are now ready to move on to the next point to measure.

To end the program press PRG and 0. Otherwise continue and collect more points.



CHAPTER

16

P39 RoadLine 3D

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- Measure 16-72

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In General

With program 39, RoadLine 3D, you can measure and setout roadlines in three dimensions.

The program contains routines for storing, checking, setting out, measuring, slope staking and reference point. Two different methods can be used while setting out, 1 conventional radial setting out and 2 orthogonal or rectangular setting out.

Structure

Store

This function is divided in 5 subsections:

6. Roadline- to store the horizontal spread of the roadline.
7. Vertical alignment – to store the vertical spread of the roadline.
8. Cross section definition – to store the different cross sections for the roadline.
9. Cross section – to describe how the different cross sections changes along the road.
10. Camber (Super elevation) – to define how much the road slopes.
11. Layer – to store road layer data.
12. Length – to store length table data (for Swedish railways).

Check

For mathematical check that the data in the areafiles is correct.

Set out

For setting out points along or parallel to the centre of the road.

Measure

For measuring in existing elements and objects that may lie along the roadline.

Slope staking

Function to find out where the ground level intersects with the finished road and to set out embankment sides.

Reference point

Function to set out a point on an optional distance from e.g. a road edge or for measuring in a point and get data for a ref. Pnt. It is also possible to define a boning (guide stake) height.

Store

With This function you store all roadline data, i.e. section interval, centre line offset, section, start- and end points of every element and the type of element. In order to survey or set out a road in P39 at all, a description of the plane, i.e. the horizontal curve, is required. In order to make a complete description of the vertical spread, a height curve, two cross sections (left and right road halves) and two descriptions of the road camber (super elevation) are required. All these tables are described using a number of elements, where the position of these elements is determined by the section (station), one section value that denotes where the element begins and another that denotes

where it ends. The section describes ones whereabouts on the road. The section always describes ones whereabouts on the road in the horizontal plane, even for the vertical descriptions. The elements in the various descriptions are not coupled together and will be dealt with separately in the calculations.

All roadline data will be stored in separate areafiles sorted after type of data according to the following:

Extension	Description
nn	Section interval and layer
nn#1	Horizontal alignment (height profile)
nn#2	Vertical alignment (height profile)
nn#3	Cross sections definition (road profile)
nn#3	Cross sections for right road half
nn#5	Cross sections for left road half
nn#6	Camber* information for right road half
nn#7	Camber* information for left road half
nn#8	Length table, for defining kilometre sectins that aren´t a kilometre (mainly for use on Swedish railways)

*Camber = Super elevation

Requirements

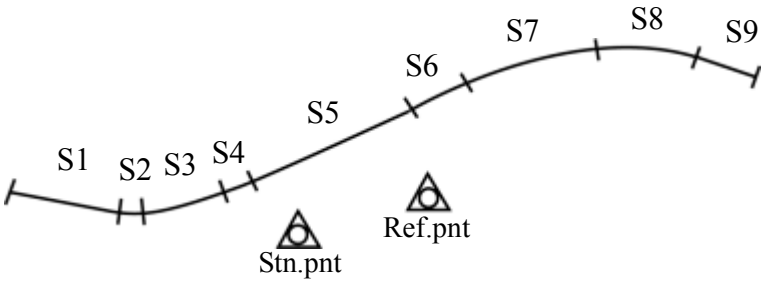
- To work with Program 39 the areafile nn#1 must be stored.
- If you wish to include heights relative to the centre of the road, the areafile nn#2 must be stored.
- If you have defined a cross section and wish to refer the heights to this, the areafiles nn#3, nn#4 and nn#5 must also be stored.

- If you wish to use the camber (super elevation) function, also the area files nn#6 and nn#7 must be stored.
- If you want to use Length tables (mainly for Swedish railways) the area file nn#8 must be stored.
- If you wish to use the layer function, the areafile nn must be stored.
- It is not necessary to define a point code in all files, but it is of great help.

Horizontal Alignment

In order to work with P39 at all, you must have keyed in data for the horizontal alignment of the roadline. This will be stored as section (station), the starting point coordinates for the element and possibly a radius or a parameter for an arc and clothoids. When you store clothoids (spirals) you can choose between keying in A-parameter or to key in radius and length. The roadline must begin and end with a straight element.

The elements on the opposite of a clothoid (spiral) must denote the radius in the conjunction. If this is infinite, the element should be a straight line, otherwise an arc.



The following data is required to describe the different types of elements for the horizontal alignment of the roadline:

Type	Label	Description
Straight	80	Section (Station)
	37	X-coordinate
	38	Y-coordinate
Arc	80	Section (Station)
	37	X-coordinate
	38	Y-coordinate
	64	Radius, Left=-, Right=+
Clothoid	80	Section (Station)
(Spiral)	37	X-coordinate
	38	Y-coordinate
	81	A-parameter

* You can choose between keying in the A-parameter or radius and length.

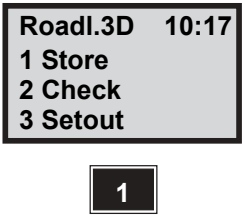
Example of an areafile with a horizontal alignment:

```
80=0.000
37=37305.028
38=73505.770
80=68.480
37=37350.638
38=73556.850
64=750.000
80=919.863
37=37480.143
38=74352.784
64=3200.000
80=1803.633
37=37023.901
38=75106.401
80=1803.634
37=37023.900
38=75106.400
```

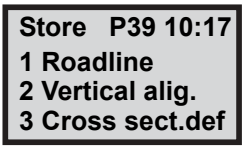
Store horizontal alignment

Select program 39 and press ENT.

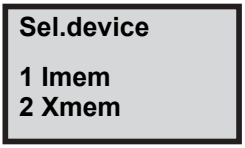
Select 1 Store.



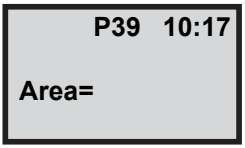
Since it's the horizontal alignment you will store, Select 1 Roadline.



Select in which memory unit you wish to store the horizontal alignment. In this case we choose 1 Imem.

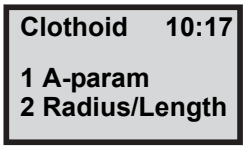


Key in the name of the Areafile in which you wish to store the roadline and press ENT. The areafile will automatically get the extension, #1.

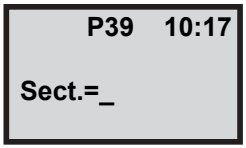


Here you can choose how the clothoid (spiral) will be described, stored and calculated; either with an

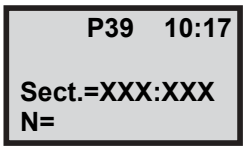
A-parameter or with radius and length. In this case we choose 1 A-param.



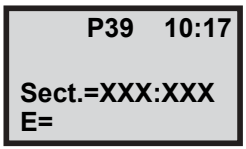
Key in the first section (station) number for the roadline and press ENT.



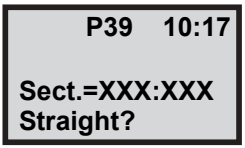
Key in the Northing value of the chosen and press ENT.



Key in the Easting value of the chosen and press ENT.

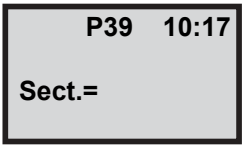


Select type of roadline element by pressing NO until the correct element type is displayed. In this example we choose Straight and press ENT.



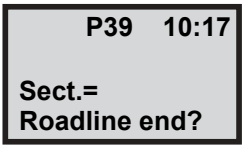
ENT

Key in the next section (station) point and repeat the above instructions.



ENT

When you are selecting the last roadline element, select Roadline end. This means that the last element will be stored as a straight line.

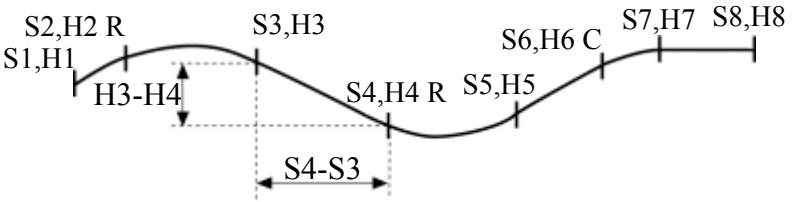


ENT

Vertical Alignment

If you have chosen to include heights in the calculations for roadline, there must be a description of the vertical alignment. The height for the roadline gives a description of the middle line in the vertical plane. A height profile is described by defining height elements with consecutive section values. The end section (station) of an element is identical to the start section (station) of the next element. The elements can be of the type straight, arc or parabola.

To define a straight element only the height and the section (station) at the start- and end points is required. A circular or a parable element also require a start slope. This means that you need to enter a start slope if the previous element type is not a straight line. If a start direction is stated, this should be used. If the coefficient for a parabola is entered as zero, the coefficient will be calculated by the program when it is to be used. This requires that a slope exists both before and after this parabolic element.



The following apply to the figure above:

S=Section (Station)
H=Height
R=Radius of circle arc
C=Coefficient for a parabola, in the form Y=C*X2.

The following data is required to describe the different element types for the vertical alignment:

Example on a areafile with a height profile:

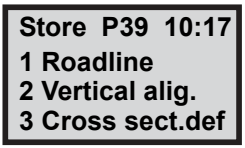
```
80=60
39=16.004
80=80
39=15.657
80=450.568
39=11.581
64=8000
80=746.568
39=13.801
80=1233.983
39=26.474
64=16000
```

Store vertical alignment

Select program 39 and press ENT.

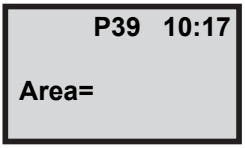
Select 1 Store.

Since it is the vertical alignment you will store, select 2 Vertical alig.



2

Key in the name of the areafile in which you wish to store the vertical alignment and press ENT. The area file will automatically get the extension, #2.



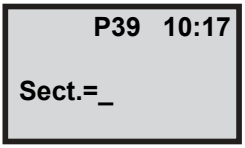
ENT

Select in which memory unit you wish to store the vertical alignment. In this case we choose, 1 Imem.

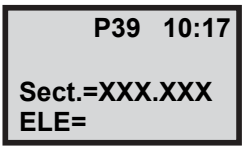
1

Select element type, 1 straight, 2 Arc, 3 Parabola or 4 Roadline end. In this case we choose 1 Straight.

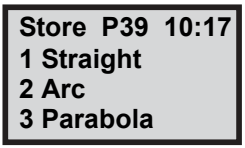
Key in the first section (station) number for the roadline and press ENT.



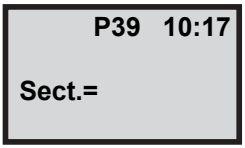
Key in the height value for the chosen section (station) and press ENT.



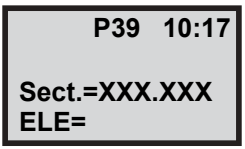
Select type of element, 1 Straight, 2 Arc, 3 Parabola or 4 Roadline end. In this case we choose 2 Arc.



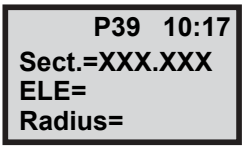
Key in the second section (station) number for the roadline and press ENT.



Key in height value for the chosen section (station) and press ENT.

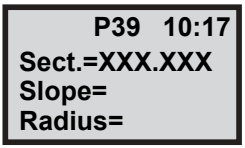


Key in the radius of the arc and press ENT. A radius that turns upwards is keyed in with a positive figure and a radius turning downwards with a negative figure.

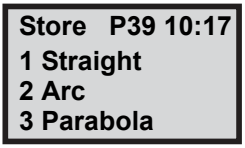


Note – *Radius: Up=+ Down=-*

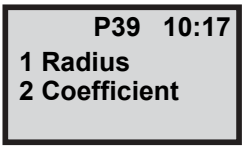
Key in a start direction for the arc and press ENT. Upwards is entered with at positive figure and downwards with a negative. This display will not be shown if this data is not required, i.e. if the first element I straight.



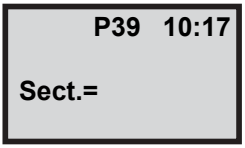
Select type of element, 1 straight, 2 Arc, 3 Parabola or 4 Roadline end. *In this case we choose 3 Parabola.*



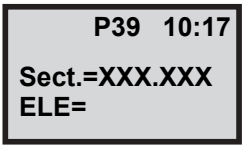
Select 1 if you wish to key in a radius for the parabola or 2 if you wish to key in a coefficient. *In this case we select 2 coefficient.*



Key in the third section number for the roadline and press ENT.

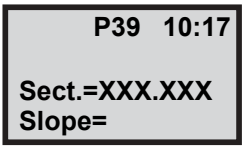


Key in the height value for the chosen section (station) and press ENT.



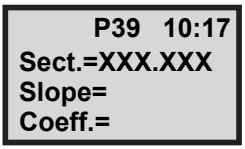
Key in a start direction for the parabola and press ENT. Upwards is entered with at positive figure and downwards

with a negative. This display will not be shown if this data is not required, i.e. if the previous element is straight.



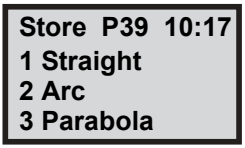
ENT

Key in coefficient for the parabola and press ENT. If you key in 0.000 the parabola will be calculated by the program provided that the intersection of both lines lies halfway between the two points that are about to be connected.



ENT

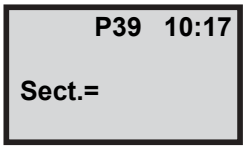
Continue to key in the different elements for the vertical alignment. Select 4 Roadline when you are finished.



4

Key in fourth and last section (station) number for the roadline and press ENT. Key in the end section (station) or

leave the line blank if you already have defined the end of the height curve. In this case we leave it blank.



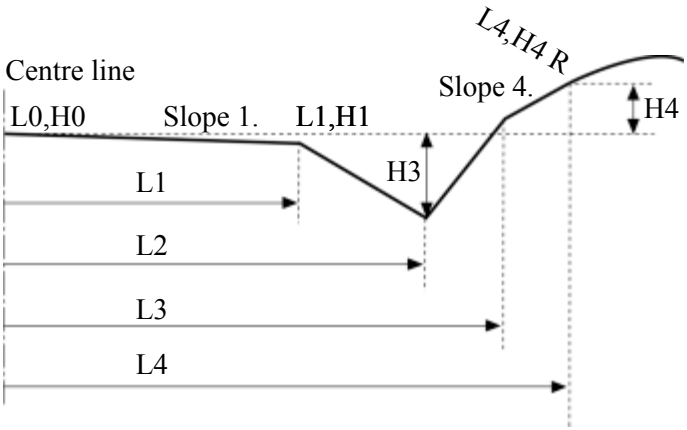
Cross Section

The cross section is divided in 3 different areafiles: #3, which contains all cross section definitions which will be used along the road, #4 which describes how the right half of the road changes along the road and #5 which describes the same thing for the left half of the road.

Cross section definitions (road profiles)

The cross section is defined by a number of breakpoints as Horizontal and Vertical offsets

(difference in height from the Centre line) and possibly a radius. If a point has a radius and there is another point further on, these two points are joined together with an arc irrespective of the direction of the tangent. The tangent direction for the radius in the starting point is defined by the direction for the previous line. If no start direction exists, the arc will get the start direction 0, i.e. horizontal direction. A radius turning upwards shall be given a positive sign and a radius turning downwards a negative sign.



An example of the road profile is shown in the figure above:

L=Distance from the centre line

H=Height difference from the Centre line

R=Radius of circle arc

The number of break points that can be used to describe the cross section is limited to 12 per road half. If the first Centre line offset is not equal to zero, it is assumed that the first point lies at a height of zero on the centre line.

It is not necessary to describe point codes for all point, but the point code is of great help if you wish to search for a specific point by name. Separate tables are used to describe which cross sections are to be used along a certain part of road. These cross section descriptions will only describe one road half only and can then be used to describe both the left and right road halves.

The points described below:

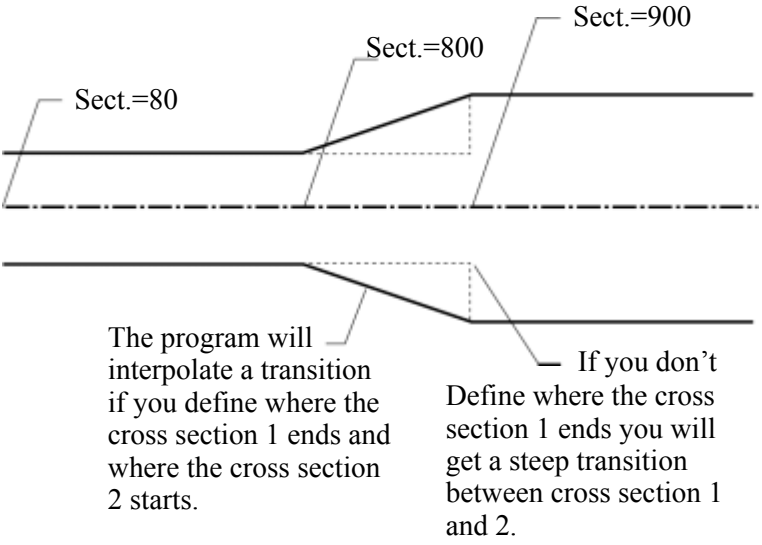
Type	Label	Description
Cross section	88	Cross section number
Straight	4	Point code
	83	Centre line offset. Distance from the Centre line to the point at witch the slope or bend shall be defined.
	85	Elevation. Difference in height from the Centre line.
Arc	4	Point code
	83	Centre line offset. Distance from the Centre line to the point at witch the slope or bend shall be defined.
	85	Elevation. Difference in height from the Centre line.
	64	Radius of the road profile. Requires a tangent direction at the point of the arc if there is no new point to follow. Up=+, Down=-

Example of an areafile with cross sections:

```
88=1
4=1
83=0
85=0
4=2
83=6
85=0.2
4=3
83=7
85=1.0
```

Cross section definitions for left and right road half (profile curve)

Changes in the cross section along the road are stored in two separate area files, one for the right and one for the left side of the road. Reference is made to the predefined profiles in areafile #3. The extension for the right half is #4 and for the left #5.


Sect.=900
Sect.=800
Sect.=80
The program will interpolate a transition if you define where the cross section 1 ends and where the cross section 2 starts.
If you don't Define where the cross section 1 ends you will get a steep transition between cross section 1 and 2.

If the beginning or end of the road is undefined, i.e. if the start section (station) for the first cross section is a distance along the roadline or if the end section (station) is defined before the end of the road, the height at the middle of the road will be valid for the whole of the cross section. If there is no cross section defined, the latest profile is valid for the remainder of the road.

The cross section definitions are stored as described below:

Type	Label	Description
Straight	80	Section (Station)
	88	Cross section number
	80	
	88	
	.	
	.	
Profile transition	80	Section (Station)
	88	Cross section number
	80	End of 1:st cross section
	80	Start of 2:nd cross section
	88	Cross section number

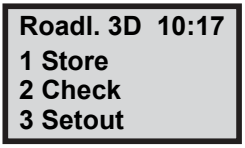
Example of an areafile with cross section definitions:

```
80=80
88=1
80=800
80=900
88=2
80=1800
```

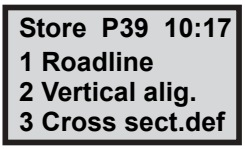
Store cross section data - with length and height difference

Select program 39 and press ENT.

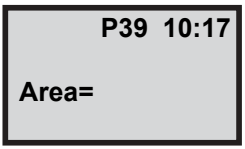
Select 1 Store.



Since it is a cross section you will store, select 3 Cross sect.def.

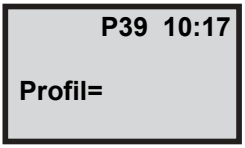


Key in the name of the areafile in which you wish to store the cross section and press ENT. The areafile will automatically get the extension, #3.

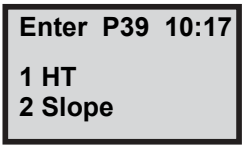


Select in which memory unit you wish to store the profile. In this case we select 1 Imem.

Key in the number for the profile you wish to define and press ENT.

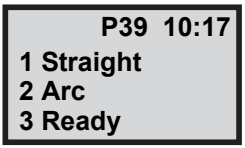


Select 1 HT, if you wish to enter the profile with distance and difference in height, or 2 Slope, if you wish to enter the profile with a slope and a distance. In this case we select 1 HT.

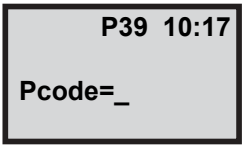


Note – *If you choose alt. 2 you can not enter the radius but you store data as a slope and the program will calculate this into a height.*

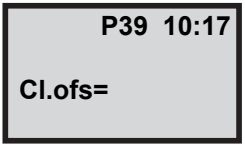
Select type of element, 1 Straight or 2 Arc. 3 Ready you choose if you are ready with storing cross sections. In this case we select 1 Straight.



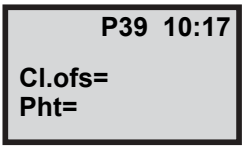
Here you can key in a code for the point. This can then be useful if you wish to search for the point by its code.



Key in the Centre line offset and press ENT.

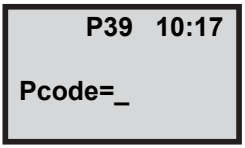


Key in the difference in height between the middle of the road and the chosen profile and press ENT.

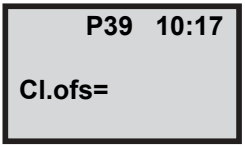


Select type of element, 1 Straight or 2 Arc. 3 Ready you choose if you are ready with storing cross sections. In this case we select 2 Arc.

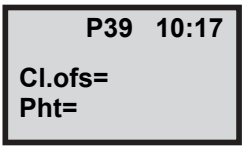
Here you can key in a code for the point. This can then be useful if you wish to search for the point by its code.



Key in the Centre line offset and press ENT.

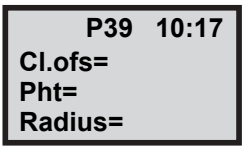


Key in the difference in height between the middle of the road and the chosen profile and press ENT



Key in the radius of the arc and press ENT. A radius that turns upwards is keyed in with a positive figure and a radius turning downwards with a negative figure.

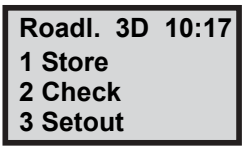
When you have keyed in all parts of the road profile you select 3 Ready.



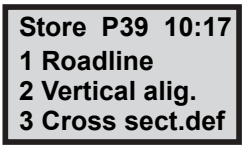
Store cross section definitions – with slope

Select program 39 and press ENT.

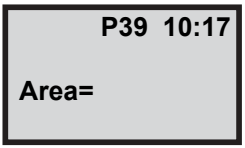
Select 1 Store.



Since it is a road profile you will store, select 3 Road profile.

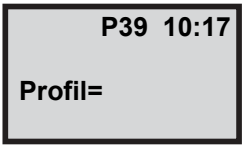


Key in the name of the areafile in which you wish to store the profile and press ENT. The areafile will automatically get the extension, #3.

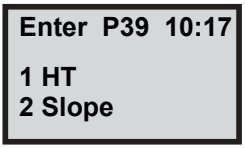


Select in which memory unit you wish to store the profile. In this case we select 1 Imem.

Key in the number for the profile you wish to define and press ENT.

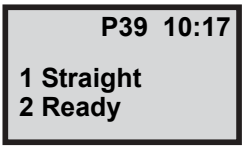


Select 1 HT, if you wish to enter the profile with distance and difference in height, or 2 Slope. If you wish to enter the profile with a slope. In this case we select 2 Slope.



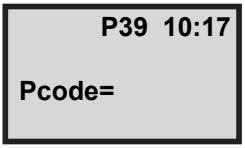
Note – *If you choose alt. 2 you can not enter the radius but you store data as difference in height and the program will calculate this into a slope.*

Proceed with 1 Straight or quit storing road profiles with 2 Ready. In this case we select 1 Straight.



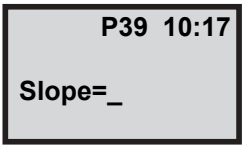
1

Here you can key in a code for the point. This can then be useful if you wish to search for the point by its code.



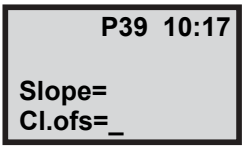
ENT

Key in the slope from the middle of the road in percent and press ENT. In this case we key in 0.02 which is the same as a slope of 2%.



ENT

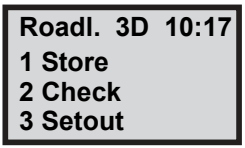
Key in the Centre line offset and press ENT. When you have keyed in all parts of the profile, select 2 Ready.



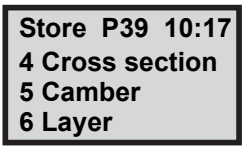
Store cross section

Select program 39 and press ENT.

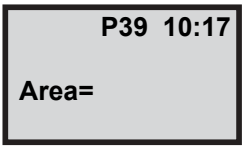
Select 1 Store and press ENT.



Since it is a cross section you are about to store, select 4 Cross section.



Key in the name of the areafile in which you wish to store the cross section and press ENT.

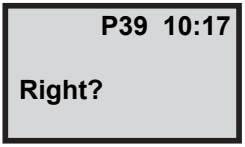


ENT

Select in which memory device you wish to store the cross section. In this case we select 1 Imem.

1

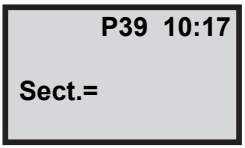
Here you can select which road half you shall define, right or left. Press ENT to accept or NO to select left.



ENT

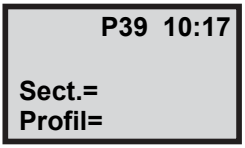
Note – *Pressing NO when the left alternative displayed means that the program jumps to the previous menu. The areafile will automatically get the extension, #4 if you select right or #5 if you select left.*

Key in the section (station) number for the first cross section and press ENT.



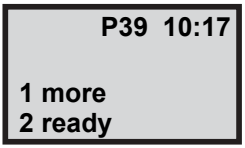
ENT

Key in the profile that should be valid for the chosen section and press ENT.



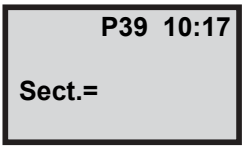
ENT

Press 1 more if you wish to continue defining more profiles for the right road half or 2 Ready if you are finished with this half of the road.



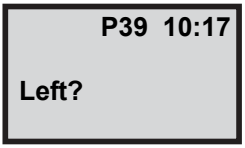
2

Key in an end section (station) for the right half of the road. This can however be blank; that means that the latest profile is valid for the remainder of the road.



ENT

Press ENT to define the left road half or NO to exit.

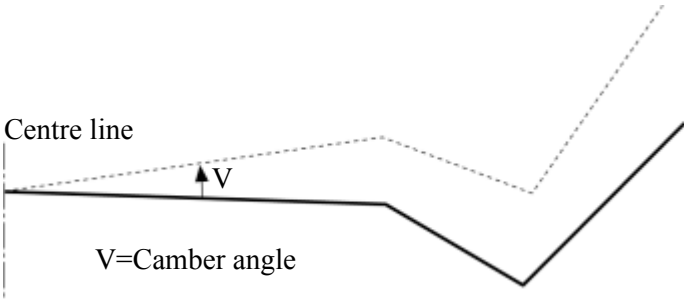


YES

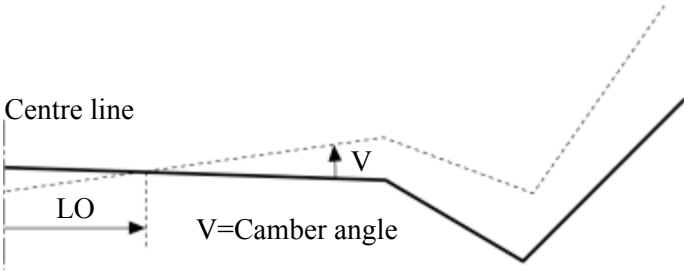
Continue describing the cross sections for the left half of the road in the same way as the right road half.

Camber

The camber (super elevation) defines the slope of the road. The left and right halves of the road are defined separately. When describing how one half of the road changes along the road, a section (station) and the slope in that section are defined. If the slope will gradually change and the correct slope will be obtained in the next section (station). The slope is stated as a decimal (tangent of the slope angle) and is positive upwards and negative downwards based on the Centre line.



Alternatively, an offset from the Centre line can be entered and the camber (super elevation) defined from this point (see fig. below)



The start section (station) of the next element is the end section (station) of the previous element. The change of the slope within the element will be linear so that it corresponds to the slope of the next element at its start point. If there is no new element, the slope of the last element will be applicable for the remainder of the roadline.

Data for the camber (super elevation) of the road are stored as follows:

Type	Label	Description
Camber about	80	Section (Station)
Centr line	44	Slope, Up=+, Down=-

Type	Label	Description
Camber with	80	Section (Station)
an offset	83	Centre line offset. Distance from the Centre line to where the road profile should slope.
	44	Slope, Up=+, Down=-

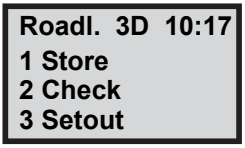
Example of an areafile with camber (super elevation) data:

80=80.000
44=0.01
80=180
83=1.5
44=0.03
80=1250
44=0.01
80=1800
.
.

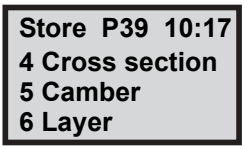
Store Camber (Super elevation) data

Select program 39 and press ENT.

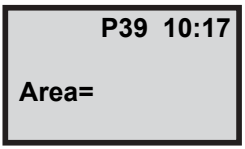
Select 1 Store and press ENT.



Since it is camber data you will store, select 5 Camber (Super elevation).



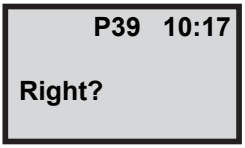
Key in the name of the areafile in which you wish to store camber (super elevation) data and press ENT.



Select in which memory unit you wish to store camber (super elevation) data. In this case we select 1 Imem.

1

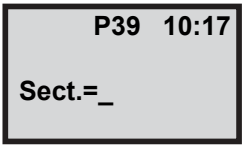
Here you can select which road half you shall define, right or left. Press ENT to accept or NO to select left.



ENT

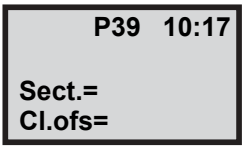
Note – *Pressing NO when the left alternative displayed means that the program jumps to the previous menu. The areafile will automatically get the extension, #6 if you select right or #7 if you select left.*

Key in the first section (station) number for the camber (super elevation) and press ENT.

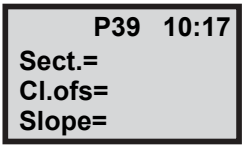


ENT

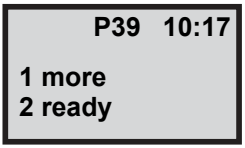
Key in a Centre line offset around which the road half should slope and press ENT. Key in zero if the slope should be around the Centre line.



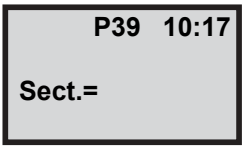
Key in the slope from the start section (station) in percent and press ENT. E.g. 2% should be key in as 0.02.



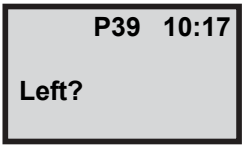
Press 1 more if you wish to continue storing camber (super elevation) data for the right road half or 2 Ready if you are finished with this road half.



Key in a end section (station) for the right half of the road. This can however be blank; that means that the latest profile is valid for the remainder of the road.



Press ENT to define the left road half or NO to exit.



Continue storing the camber data for the left half of the road in the same way as for the right road half.

Layers

The road consists of different layers. At start-up you can key in the layer you wish to work with and what point code the road embankment should have (this to identify the roadway). These layers must be prestored in an areafile. This areafile also contains the layer height. New cross sections will then be calculated continuously. The changes lies in where the roadway intersects with the road embankment. If the roadway has a slope, the height difference from the original cross section will be larger than the layer heights, since the layer runs with the slope of the roadway. If no layers are defined, the unmodified cross

section will be used. A single roadway gives only one point of intersection. The roadway in this example has a slope of the angle v.

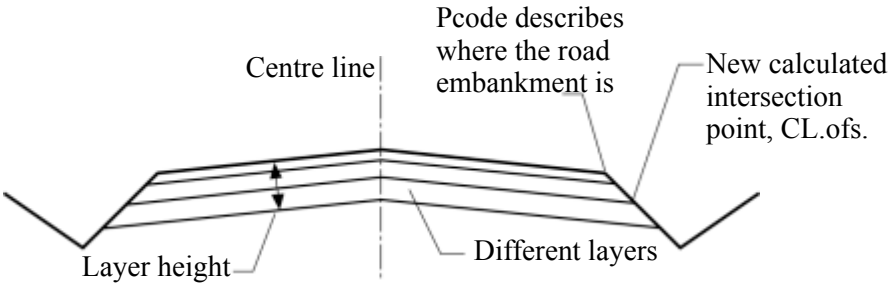


Figure 16.15

If the cross section have two embankments, two points of intersection will be calculated.

The point code denotes where the road embankment is, i.e. which element that is the road embankment. The program will search after a point with a given point code and will then lower the element that ends with the road embankment code. If there are more points with the exact code the last point will be used (highways can have two road embankments). The program will then calculate new cross section points for the road embankments. If there are no point code entered or if the entered point code does not exist, it is assumed that the roadway begins at the middle of the road.

The different layers for the road are described as follows:

Type	Label	Description
First layer	80	Start section (station)
	4	Point code for road embankment
	86	Layer ident., name or no.
	0	Layer description, e.g. type of material
	87	Difference in height from the road profil
Next layer	86	Layer ident., name or no.
	0	Layer description, e.g. type of material
	87	Difference in height from the road profil

Example of an areafile with layer data:

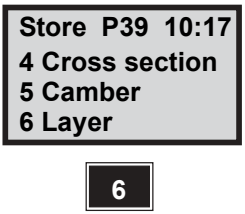
```
4=2
86=1
0=LAYER1
87=0.2
86=2
0=LAYER2
87=0.5
86=3
0=LAYER3
87=0.8
```

Store layer data

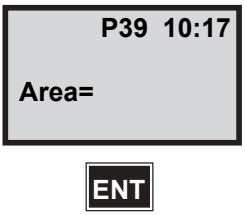
Select program 39 and press ENT.

Select 1 Store and press ENT.

Since it is layer data you are about to store, select 6 Layer.

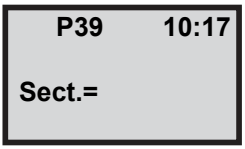


Key in the areafile in which you want to store layer data and press ENT.

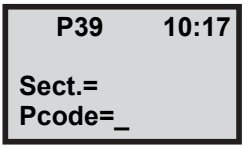


Select in which memory unit you wish to store layer dta. In this case we select 1 Imem.

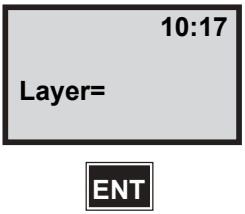
Key in the first section number and press ENT.



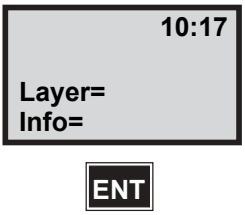
Key in a point code for the road ambankment and press ENT.



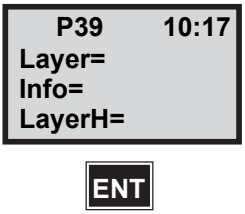
Key in a identification for the chosen layer, brief name or number and press ENT.



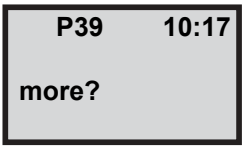
Key in a description of the layer and press ENT.



Key in the difference in height to the cross section and press ENT.

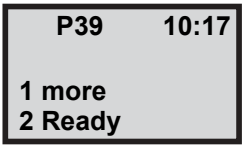


Do you wish to continue defining more layers for the current section you press ENT, Otherwise press NO. In this case we press NO.



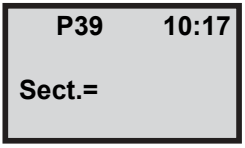
NO

Press 1 more if you wish to continue defining layers for other sections or 2 Ready if you are finished.



2

Key in a end section (station) for the keyed in layer in layer data and press ENT. This can however be blank; that means that the latest layer definition is valid for the remainder of the road.



ENT

Length Table

Swedish railways use a special section definition. Each section is described as an even kilometre figure. If a railway track is modified, e.g shortened, the kilometre figures does no longer correspond with the actual track length. This is where the length table comes in use. Here label 80, which in all other RoadLine applications stores section (Sect.) data, is now used for storing the kilometre figure of the length table. RoadLine section is now stored in label 35 instead.

The length table must always be stored with the file extension #8.are. This will be done automatically when keying in length data from a Geodimeter CU. All kilometre data about the length table is stored in label 80. All other Roadline section data (S) now uses label 35 if Length table is used.

When storing a Length table from the Geodimeter control unit you choose alternative 7 Lentos from the Store menu. The keying in of length data can be done in two different ways:

35=3+955.364 or
35=3 955.364

meaning kilometre no. 3 has a length of 955.364 metres. The difference between the two examples is that you can use either a + sign or a space between the kilometre number and the length. If you are loading the length table data from a computer it is best to use the + sign.

Note – *If you are going to key in a length table to a Geodimeter CU it is important that you key in this table (#8.are -file) before any other Roadline data. Otherwise wrong labels will be used for the rest of the Roadline calculations. If you transfer length table data from a*

computer it doesn't matter when you do this – the right labels are used automatically.

Example of an areafile with length table data:

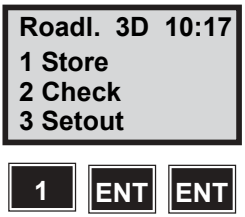
80=1	for kilometre no.1
89=1002.892	length of kilometre no.1
80=2	for kilometre no.2
89=967.475	length of kilometre no. 2
80=3	for kilometre no.3
89=955.364	length of kilometre no. 2

Store length data

This program is mainly used for Swedish railways.

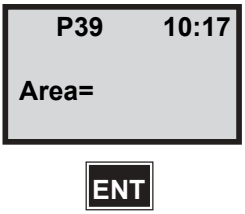
Select program 39 and press ENT.

Select 1Store and press ENT twice.

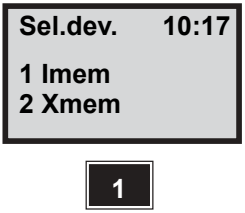


Since it is length data you are about to store, select 7 Length.

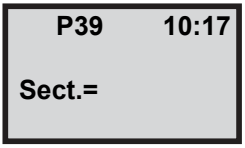
Key in the name of the area file in which you wish to store length data and press ENT.



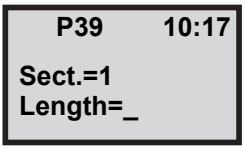
Select in which memory unit you wish to store layer data. In this case we select 1 Imem.



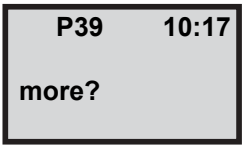
Key in the first section number and press ENT.



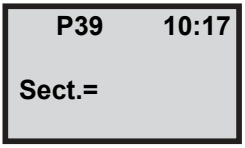
Key in actual length for the first kilometre and press ENT.



Do you want to enter more lentos? Press ENT to add more lentos or NO to exit Length. In this example we will enter one more length.

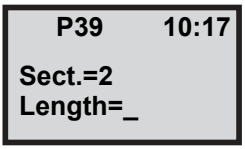


Key in the second section number and press ENT.



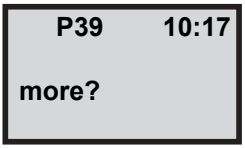
ENT

Key in actual length for second kilometre and press ENT.



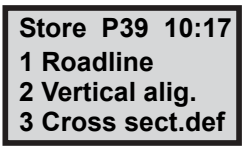
ENT

Do you want to enter more lentos? Press ENT to add more lentos or NO to exit Length. In this example we are satisfied with 2 lentos and answer NO.



NO

You are taken back to the Store menu an can now continue with Program 39.



The length table must always be stored with the file extension #8.are. This will be done automatically when keying in length data from a Geodimeter CU. All kilometre data about length tables is stored in label 80. All other Roadline section data (S) now uses label 35 if Length table is used.

Example of an areafile with length table data:

89=1002.892	length of kilometre no. 1
80=2	for kilometre no. 2
89=976.475	length of kilometre no. 2
80=3	for kilometre no. 3
89=955.364	length of kilometre no. 3
.	
.	

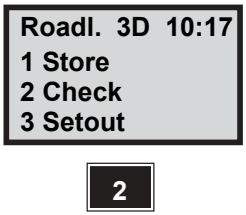
Check

This function mathematically checks that the data in the areafiles is correct. All errors in excess of 20mm horizontally and 10mm vertically will be displayed and the element in which they occur. The control function will also notify slope deviations larger than 0.01, i.e. 1%. Errors which occur due to wrongly keyed in data can be easily rectified with the help of Edit.

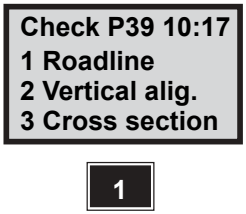
Note – *A detected error can depend on either keyed in errors or incorrect design of the roadline.*

Select program 39 and press ENT.

Select 2 Check and press ENT:



Select which type of object you wish to check. In this case we select 1 Roadline.



The other options are:

2 Vertical alig.

3 Cross sect. def.

4 Camber

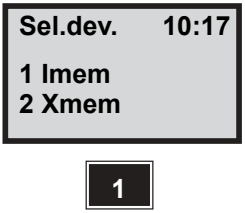
5 Layer

6 Length

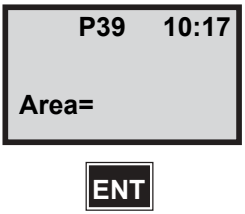
7 All files

8 Exit

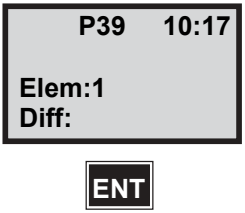
Select in which device roadline data is stored. In this case we select 1 Imem.



Key in the name of the area file you wish to check and press ENT.



The program check each element stored.



Note – *A comparison with the total longitudinal centre line measurement of each individual section (station) is carried out. If the final result gives an error message, one or more elements contain errors are ≥20mm. Recheck the roadline and define the element with an error. The element can be changed with Edit.*

Setout

Before any setting out task can be commenced you will have to do a free or known station establishment. This is done with Program 20, Stn Est. After having stored the roadline and thereafter checked that it is OK you can start with setting out. After keying in section (station) and Centre line offset values the program will calculate bearing and distance to these roadline points. Three-dimensional setting out of cross sections can be performed if heights have been included in the station establishment.

Storage of control data

The coordinate deviations will represent the differences between the stored set out point coordinates and the actual set out point coordinates. This is the basis of the printed out data sheet which will act as proof of having carried out your setting out task to within the contract specified accuracy.

These deviations (dN, dE, dELE) are much easier to use than comparing coordinates. If you don't want to store any control data, clear the suggested Job file, and press ENT.

Control data that will be stored are:

Label	Description
80 (or 35)	Section (Station)
83	Centre line offset
39	ELE
86	Layer
87	Layer height
36	Ht.Ofs
40	dN
41	dE
42	dELE

If height measurement is carried out elevations are also stored (staked elevation). If you wish to store other control data you can Configure the user defined output table.

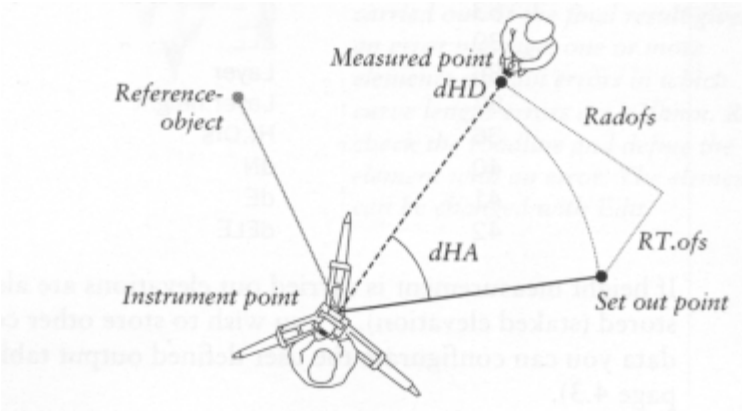
How to combine countdown to zero and radial/right angle offset for setting out

In order to benefit most from the inherent intelligence off your instrument, we recommend that you try to combine the above mentioned setting out methods. Here below is an example:

1. If the setting out data for the first section (station) is OK, press ENT and the instrument will automatically adopt

TRK mode. The display will show the calculated bearing and the dHA.

2. Rotate the instrument until the display shows 0.0000 opposite dHA. With a servo instrument, press .
3. The instrument is now pointing in the direction of the point.
4. Guide the prism bearer on line with help of the Tracklight.
5. As soon as the prism comes within the measurement beam, you will see dHD=remaining distance to your set out point.
6. If you are in robotic mode, you can easily translate the dHA and dHD values into Radofs. and RT.ofs to the point. When both these values are 0, the correct lateral set out position is reached.

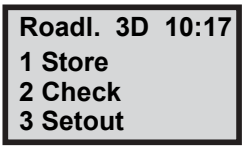


Setout

Select program 39 and press ENT.

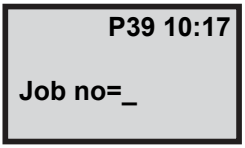
PRG 3 9 ENT

Select 3 Setout and press ENT.



3

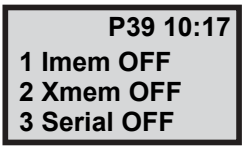
Key in the job file in which you want to store the set out point coordinate deviations.



ENT

Note – *Displayed if Job/Mem is switched on (MNU61)*

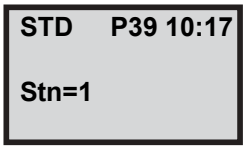
Select in which memory unit you wish to store the data and press ENT. In this case we select 1 Imem.



1 ENT

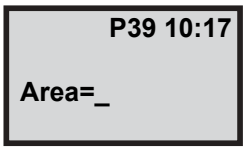
Note – *Only displayed if Job/Mem is switched on (MNU61)*

Is this the station you choose when you ran program 20, prior to P39? If no station establishment has been made, P39 will automatically start P20. It is impossible to start with setting out before you have established your instrument. In this example we accept the station and press ENT.



Note – *Only displayed if Stn is switched on (MNU61)*

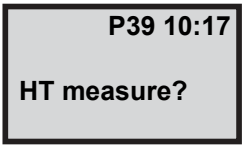
Key in the name of the area file in which the roadline data is stored and press ENT.



Select in what type of device in which the roadline data is stored. In this case we choose 1 Imem.

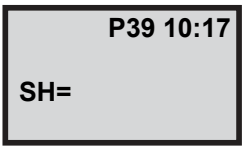
1

Do you wish to set out heights? Press ENT to accept. If you select not to set out heights the answer will be NO which means that the signal height will not be prompted. In this case we choose to accept with ENT.



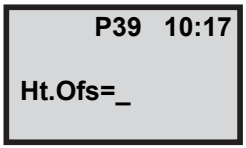
ENT

Enter the signal height and press ENT. This question only appears if you have chosen to include heights in the previous display.

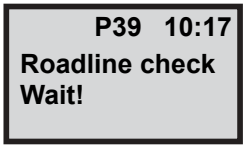


ENT

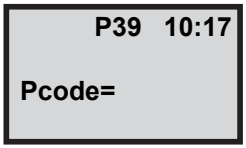
Key in a boning (guide stake) height if you wish to move up the set out point on the rod and press ENT.



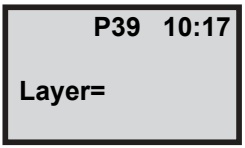
The program checks the element combinations. Wait!



If you have chosen to include point codes you can key in a code here. The program will choose points with this code. If you have chosen not to include point codes, leave this line blank and press ENT.

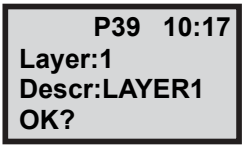


Key in the layer on which you wish to set out the point and press ENT or leave the line blank if you don't want to work with layers.



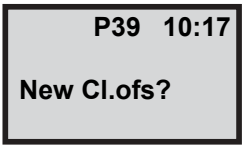
ENT

Is this the correct layer? If not press NO. In this case we accept with ENT.



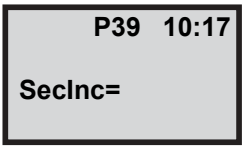
ENT

Do you want the program to calculate a new centre line offset, see figure 16.15 on page 16-42, for the road embankment press ENT, otherwise press NO and you will work at the same centre line offset. This display will not be shown if you have not defined a layer.



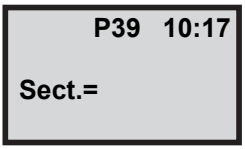
ENT

Select which section interval you shall have in this roadline and press ENT. If you choose this interval when you stored the roadline, the program selects that value.



ENT

The program suggests the last used section (station) in the area file, but this can easily be changed into any value. In this case we accept the section (station) with ENT.



ENT

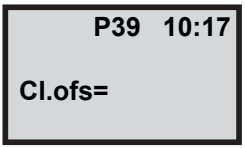
Setout With Countdown to Zero

Here the layer information is displayed for the chosen section. Press ENT to proceed.

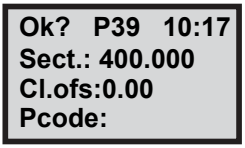
ENT

Now you can select the offset value you wish to set out. In this case we select 0 and press ENT. Is there a cross

section stored will the offset values be taken from this, or by the point code.



Is the setting out data OK? If so, press ENT. The instrument automatically adopts the TRK-mode.

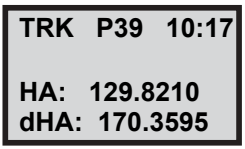


The instrument should be rotated to the right 170.3595 grads.

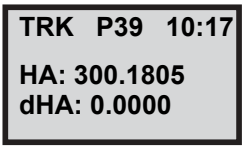
-=Left

+=Right

This method is called the count down to zero angle method. See page 16-69 for the radial/right angle method.



When the instrument displays 0.0000 opposite dHA it is pointing in the direction of the point. HA is the calculated bearing to the point.



Measurement tip – for mechanical

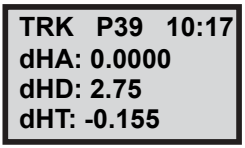
When using the count down to zero as your setting out method, it is convenient to decrease the number of decimals in the Label 77=dHA. This can be done via menu 13.

As soon as the prism comes within the measurement beam you will see dHD, i.e. how much you must change the horizontal distance from the instrument.

+=increase

-=decrease

In this case the prism is on line but the distance has to be increased by 2,75m.

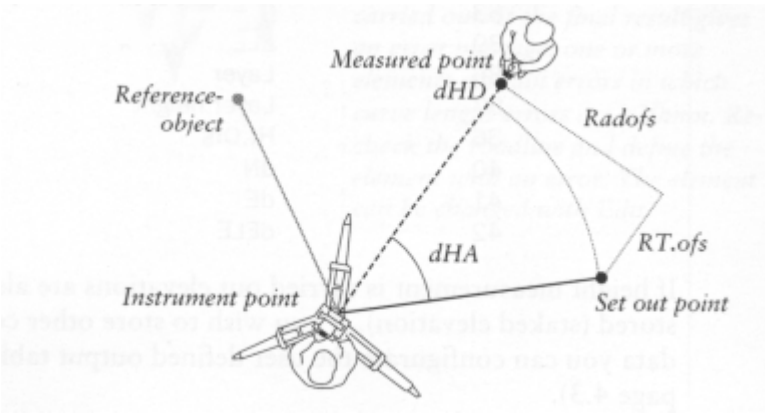


When you are finished, i.e. dHD=0.000 you can press REG for the next point or ENT to see Radofs and RT.ofs. In this case we press ENT.

When Radofs and RT.ofs are 0.000 you have found the correct lateral set out position.

```
TRK  P39  10:17
Radofs: 0.00
RT.ofs: 0.00
dHT: 0.000
```

ENT



Note – *Skip point*

If during the setting out you have difficulties in being able to set out the point, you have a opportunity to skip it. Just turn the instrument until HD disappears (30cm) and press REG and the question "Skip Point?" will be displayed. Answer ENT to this question and the program will continue with the next setting out point.

When you press REG, these are the values which are stored in the Job file, i.e. deviations from the correct set out

point coordinates. Press ENT to see the coordinates for the point.

```
TRK  P39  10:17
dN: 0.00
dE.ofs: 0.00
dELE: 0.000
```

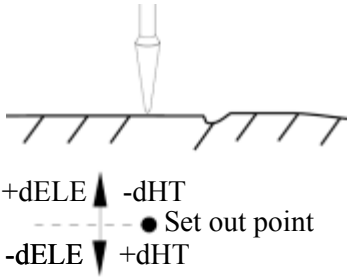
ENT

Rotate the instrument with servo

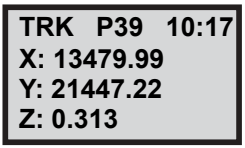
If you press this key without measured distance ELE=the height at the theoretical set out point.

If you press this key with measured distance ELE=the height at the measured set out point.

If you press this key longer than 1 sec. with measured distance ELE=the height at the theoretical set out point.

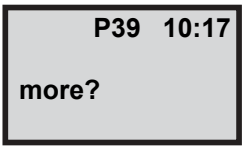


These are the actual coordinates of the set out point's present position, Press REG to store the deviations seen on the previous page.



REG

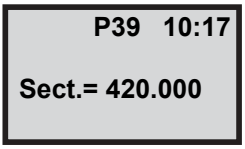
Do you wish to continue setting out more points, press ENT. Otherwise press NO and you will return to the main menu. In this case we continue with ENT.



ENT

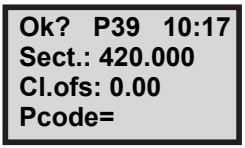
Setout With Radial/Right Angle Offset

The program suggests the next section (station). Key in the section (station) and the centre line offset you wish to set out…

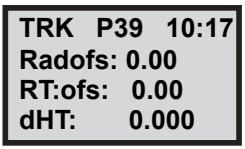


ENT

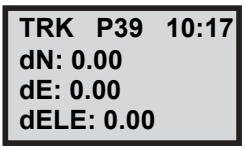
Is the setting out data OK? If so, press ENT. The instrument automatically adopts the TRK-mode. When the prism is found, press ENT to see Radofs and RT.ofs.



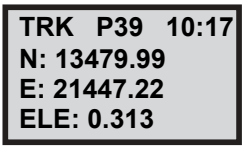
When Radofs and RT.ofs are 0.00 the correct lateral set out position has been found. Press REG directly if you do not wish to see the other display pages. In this case we press ENT to see the coordinates and deviations.



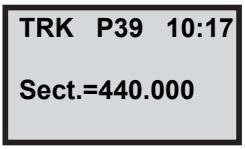
When you press REG, these are the values which are stored in the Job file, i.e. deviations from the correct set out point coordinates. Press ENT to see the coordinates for the point.



These are the actual coordinates of the set out point's present position. Press REG to store the deviations seen on the previous page.



The program suggests the next section (station). Key in the section (station) and the Centre line offset you wish to set out…



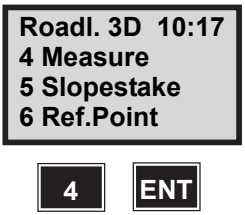
Measure

This option enables the operator to localize the section (station), Centre line and the difference in height relative to a stored roadline. You simply measure an arbitrary point and the program calculates the section (station)/Centre line offset and coordinates of the point. This part of the program is especially suitable for cross sectioning or localizing an obstacle when checking a planned section of road.

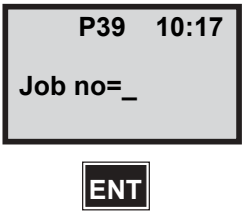
Measure

Select program 39 and press ENT until this display appears.

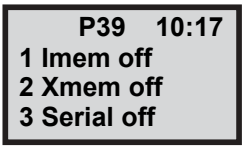
Select 4 Measure and press ENT.



Key in the Job file in which you wish to store the measured point coordinate deviations.



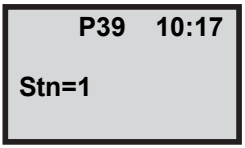
Select in which memory unit you wish to store the Job file and press ENT. In this case we select 1 Imem.



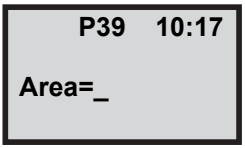
Note – *Only displayed if Job/Mem is switched on (MNU61)*

Is this the station you chose when you ran program 20, prior to P39? If no station establishment has been made, P39 will automatically start P20.

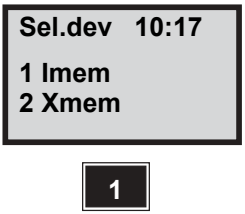
It is impossible to start with setting out before you have established your instrument. In this example we accept the station and press ENT.



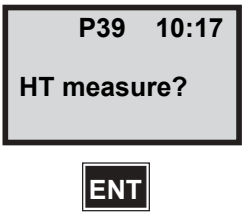
Key in the name of the area file in which the roadline data is stored and press ENT.



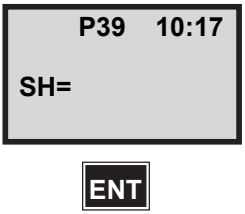
Select in what type of device in which the roadline data is stored. In this case we choose 1 Imem.



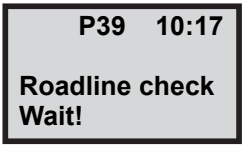
Do you wish to set out heights? Press ENT to accept. If you select not to set out heights the answer will be NO which means that the instrument height and the signal height will not be prompted. In this case we choose to accept with ENT.



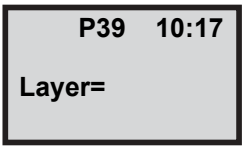
Enter the signal height and press ENT. This question only appears if you have chosen to include heights in the previous display.



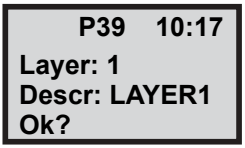
The program checks the stored data. Wait!



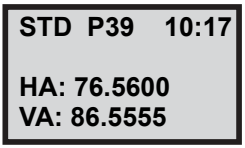
Key in the layer on which you wish to measure the point and press ENT or leave the blank if you don't want to work with layers.



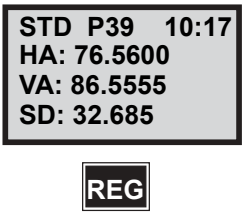
Is this the correct layer? If no press NO. In this case we accept with ENT.



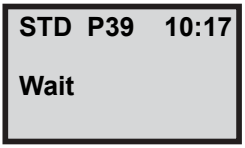
The instrument is now in theodolite mode. Aim at the first point and press A/M to start measurement.



Press REG to check the points location according to the roadline.



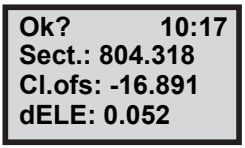
The program checks if the points lays close to any of the roadline sections (stations). If no section (station) is found INFO 32 will be displayed.



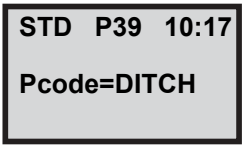
Here the layer information is displayed for the chosen section. Press ENT to proceed.

The point lays 16.891m to the left of the roadline section (station) 804.318. If this is OK, press YES. If you answer

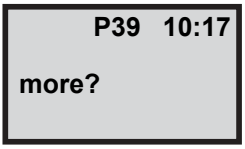
NO, the program will check if the point lays close to any other section (station).



Here you have the opportunity to choose a point code for the measured point.

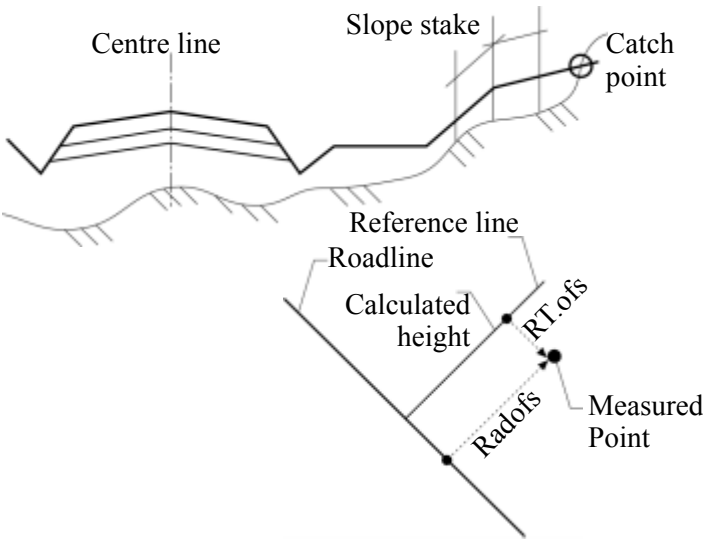


Do you wish to continue measuring more points, press ENT. Otherwise press NO and you will return to the main menu. In this case we exit with NO.



Slope Staking

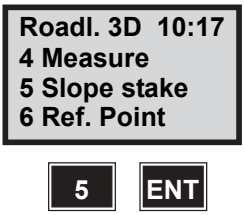
This option is used to find out where the ground level intersects with the finished road and to set out embankment sides. The heights cannot be deselected, which means that the height curve for the centre line of the road must exist to be able to run this option, (area files nn#1, nn#2, #3, #4, #5 are required).
First you have to select the section (station) to work at. The program will calculate N, E, ELE using C1.Offset=0, and the last point in the cross section. This results in that a reference line will be drawn between these two points in the horizontal plane.
During the survey you will get continuous information about Radofs (C1.Offset), RT.ofs (Deviation from section (station)) and dELE (Deviation from stored cross section). When dELE is zero the Catch point is found. The surveyor can press REG when he thinks he is close enough to the point.



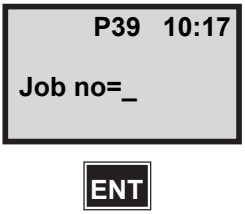
Slope Stake

Select program 39 and press ENT until this display appears.

Select 5 Slope stake and press ENT.

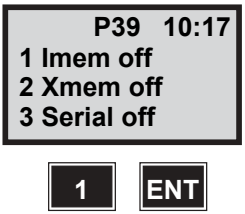


Key in the Job file in which you wish to store the measured points data and press ENT.



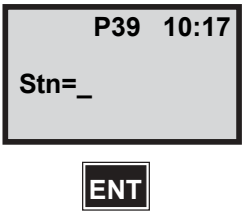
Note – *Displayed if Job/Mem is switched on (MNU61)*

Select in which memory unit you wish to store the Job file and press ENT. In this case we select 1 Imem.



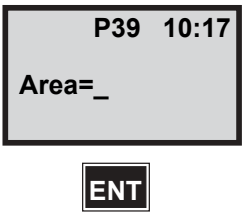
Note – *Only displayed if Job/Mem is switched on (MNU61)*

Is this the station you chose when you ran program 20, prior to P39? If no station establishment has been made, P39 will automatically start P20. It is impossible to start with setting out before you have established your instrument. In this example we accept the station and press ENT.



Note – *Only displayed if Stn is switched on (MNU61)*

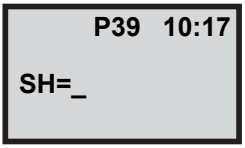
Key in the name of the area file in which the roadline data is stored and press ENT.



Select in what type of device the roadline data is stored. In this case we choose 1 Imem.

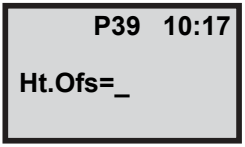
1

Enter the signal height and press ENT.



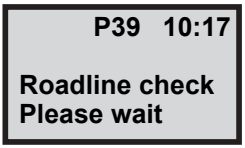
ENT

Key in a boning (guide stake) height if you wish to move up the measured point on the road and press ENT.

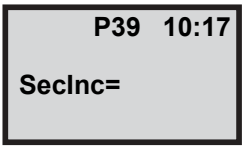


ENT

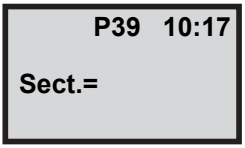
The program checks your chosen roadline. Please wait.



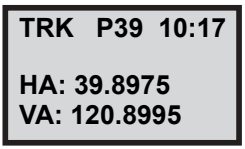
Select which section interval you shall have in this roadline and press ENT. If you choose this interval when you stored the roadline, the program selects that value.



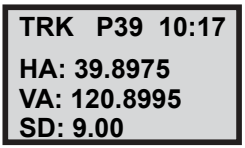
Do you know which section (station) is closest to the point you are looking for can key in this and press ENT. Otherwise you leave the line blank and press ENT and let the program calculate in the closest section (station) to your present position. *See If you know which section is closest to the point...(cont) page 16-83.*



You are now in theodolite mode and can start measuring. Aim at the prism to start the measurement.

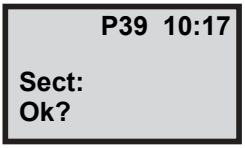


When the distance has been measured, press REG to check the point you stand at.



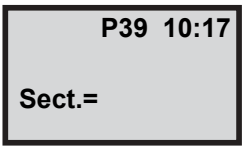
REG

The program suggests a section (station) on the roadline. Accept this section with ENT or press NO to look for another section.



ENT

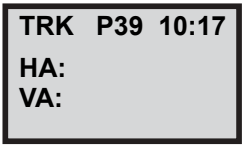
Select an even section (station) or accept the suggested section (station. In this case we accept the suggested section with ENT.



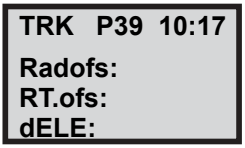
ENT

If you know which section is closest to the point...(cont)

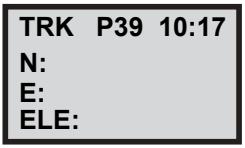
Aim at the prism to see how you lie relative to the current cross section.



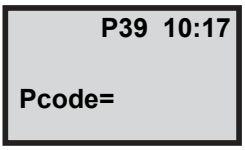
Here you can see how you lie relative to the cross section. When both RT.ofs and dELE are zero you have found the cross section and can mark your Catch pnt. Press ENT to see the coordinates for the point or REG to continue with the next point.



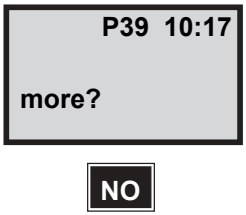
Press REG to store the point.



Here you have an opportunity to store a point code for the measured point.



Do you wish to continue looking for new points press ENT and you can key in the section (station). In this case we choose to exit with NO.



Reference Point

The program can be used to mark out the road design with bonings (guide stakes), i.e. rods with height marks for the road embankments.

This is practical in those cases you have to dig the cut slope or place material to create the fill, when the bonings (guide stakes) have to be located outside the road embankment.

The program can both be used for setting out and surveying reference points along the roadline.

Setout

When setting out the operator enters the point code for the road embankment or the section (station) and centre line offset for the reference point, i.e. first the road embankment and then a distance to where the reference point should be located. See figure 16.16. The program uses the direction of the line sloping from the previous break point in the cross section.

Note – *dELE runs with the slope of the roadway.*

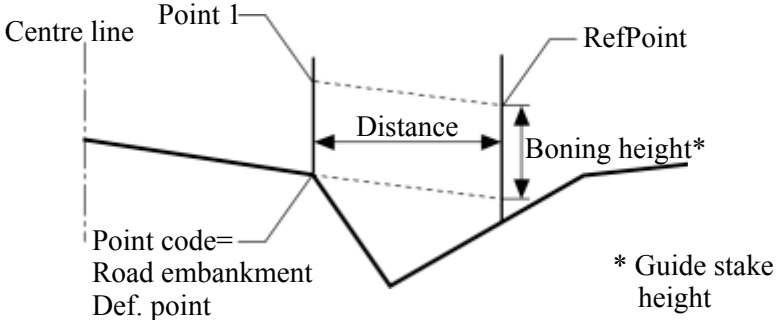


Figure 16.16

For highways the distance can have to be entered with a negative sign for the road embankment closest the centre line if this lies in the middle of the two road halves. This reference point must be located a bit inside the roadway if you wish to have a correct height, depending on that the program otherwise will use the embankment slope.

Setting out two reference heights on the same rod.

The program also gives you the opportunity to setting out two reference points on the same rod. Default is that reference point 1 indicates one road embankment and that reference point 2 indicates the other. See figure 16.17.

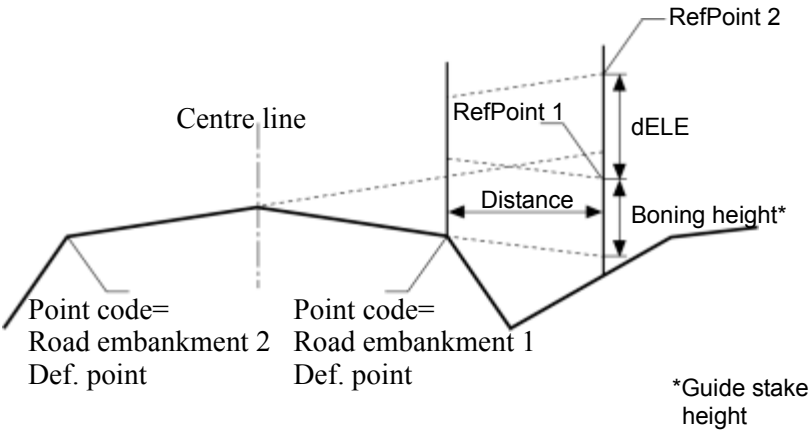
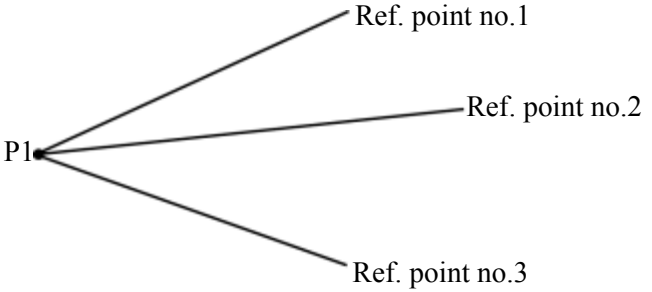
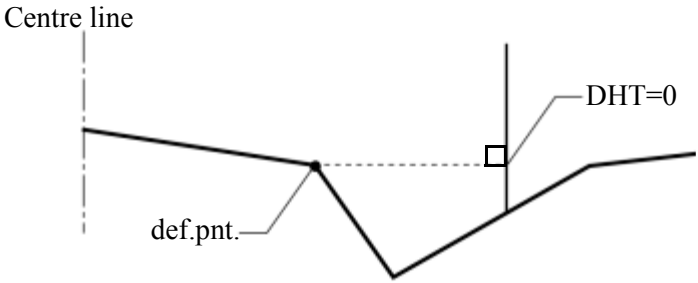


Figure 16.17

Measuring

When measuring the operator enters the section (station) and centre line offset for the def. point. Then you measure a optional number of reference points, see fig. below.





Reference Point - Setout

Select program 39 and press ENT until this display appears.

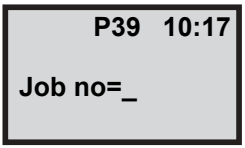
PRG 3 9 ENT

Select 6 Ref.Point and press ENT.

```
Roadl. 3D  10:17
4 Measure
5 Slope stake
6 Ref. Point
```

6 ENT

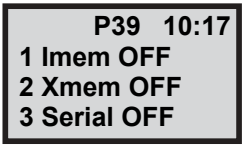
Key in the job file in which you wish to store data for the reference points and press ENT.



ENT

Note – *Displayed if Job/Mem is switched on (MNU61)*

Select in which memory unit you wish to store data for the reference points and press ENT. In this case we select 1 Imem.

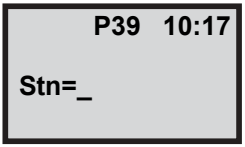


1 ENT

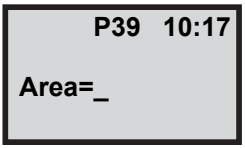
Note – *Only displayed if Job/Mem is switched on (MNU61)*

Is this the station you chose when you ran program 20, prior to P39? If no station establishment has been made, P39 will automatically start P20.

It is impossible to start with setting out before you have established your instrument. In this example we accept the station and press ENT.

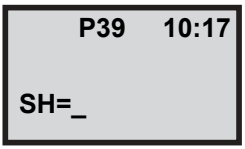


Key in the name of the area file in which the roadline data is stored and press ENT.

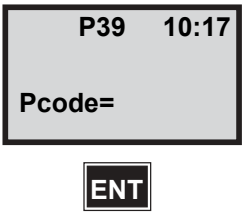


Select in what type of device the roadline data is stored. In this case we choose 1 Imem.

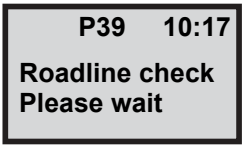
Enter the signal height and press ENT.



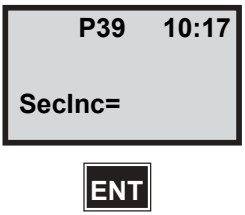
Key in the point code for the definition point that has the correct centre line offset and press ENT, or leave the line blank to enter the centre line offset manually.



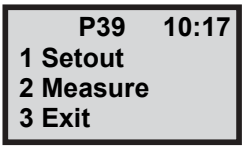
The program checks your chosen roadline. Please wait.



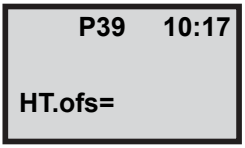
Select which section interval you shall have in this roadline and press ENT. If you chose this interval when you stored the roadline, the program selects that value.



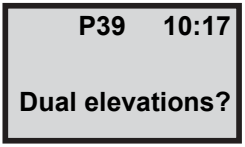
Select 1 to set out reference points, 2 to measure reference points or 3 to end program. In this case we select 1 Setout.



Key in a boning (guide stake) height if you wish to move up the setout point on the rod and press ENT.

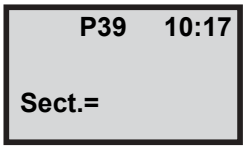


Press ENT if you wish to set out two elevations on the same rod. In this case we press NO to set out only one point.

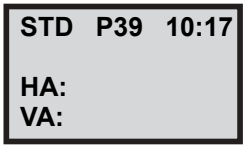


Do you know which section (station) is closest to the point you are about to set out you can key in this and press ENT. Otherwise you leave the line blank and press ENT and let the program calculate the closest section (station) to your

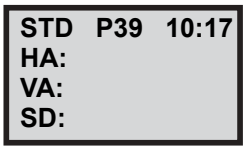
position. See *If you know which section is closest to the point...(cont) page 16-94.*



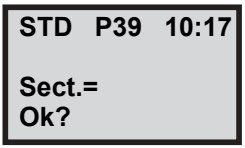
Aim at the prism and press the A/M-key to start the measurement.



Press REG to store the measurement.

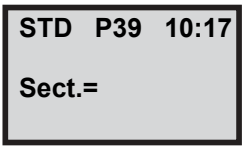


The program suggests a section (station) on the roadline. Accept this section (station) with ENT or press NO to look for another section (station).



ENT

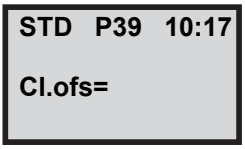
Select an even section (station) or accept the suggested section (station). In this case we accept the suggested section (station) with ENT.



ENT

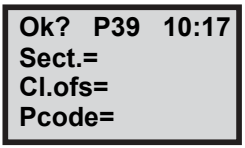
If you know which section is closest to the point...(cont)

If you have keyed in the point code for the definition point the program suggests a centre line offset. Otherwise you will have to key in the correct centre line offset. Press ENT or key in a new value.

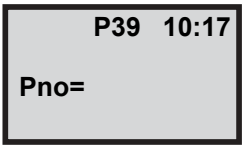


ENT

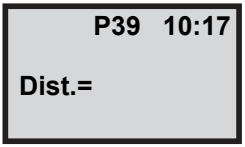
Is the definition point data OK? If so, press ENT, otherwise press NO. In this case we press ENT.



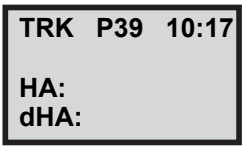
Key in a number for the reference point you are going to set out.



Key in the distance that is valid between the definition point and the point you are going to set out and press ENT.



The program automatically adopts TRK-mode. Aim to the prism to start the measurement.

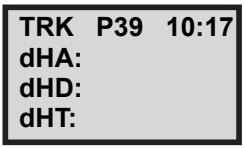


As soon as the prism comes within the measurement beam you will see dHD,i.e. how much you must change the horizontal distance from the instrument.

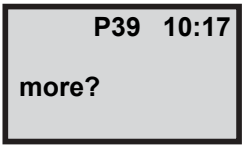
+=increase

-=decrease

When you think that you are close enough to zero, press REG to register the point or press ENT if you wish to set out with the radial/right angle offset method.

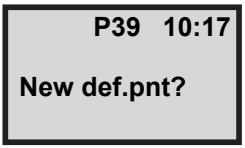


Do you wish to set out more reference points for this section press ENT and you are able to key in a new point number and a new distance. In this case we press NO.

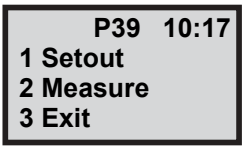


Do you wish to set out new reference points for another section press ENT. That means that you are able to key in a

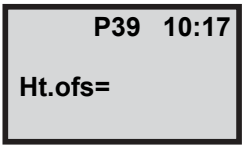
new section (station) number. In this case we choose to exit with NO, in order to set out two reference points.



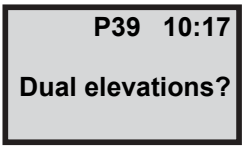
Select 1 to set out reference points, 2 to measure reference points or 3 to end program. In this case we select 1 Setout.



Key in a boning (guide stake) height if you wish to move up the setout point on the rod and press ENT.

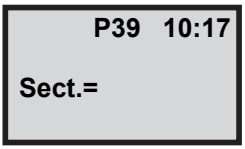


Press ENT if you wish to set out two elevations on the same rod. In this case we press ENT.



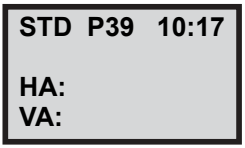
ENT

Do you know which section (station) is closest to the point you are about to set out you can key in this and press ENT. Otherwise you leave the line blank and press ENT and let the program calculate the closest section (station) to your position. See *If you know which section is closest to the point...(cont) page 16-100.*



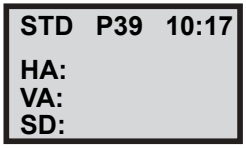
ENT

Aim at the prism and press the A/M-key to start the measurement.

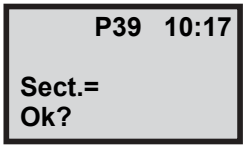


ENT

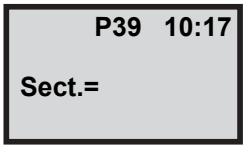
Press REG to store the measurement.



The program suggests the section (station) that lies closest to the measured point. Accept this section (station) with ENT or press NO to key in a new section (station).

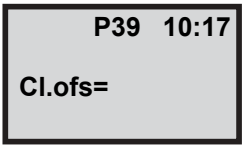


Select an even section (station) or accept the suggested section (station). In this case we accept the suggested section (station) with ENT.



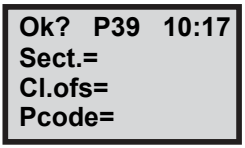
If you know which section is closest to the point...(cont)

If you have keyed in the point code for the definition point the program suggests a centre line offset. Otherwise you will have to key in the correct centre line offset. Press ENT or key in a new value.



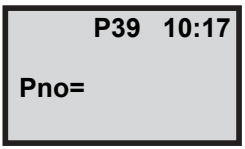
ENT

Is the definition point data OK? If so, press ENT, otherwise press NO. In this case we press ENT.



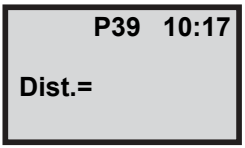
ENT

Key in a number for the reference point you are going to set out.

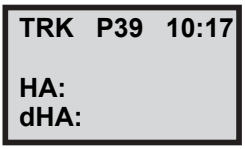


ENT

Key in the distance that is valid between the definition point and the point you are going to set out and press ENT.



The program automatically adopts TRK-mode. Aim to the prism to start the measurement.

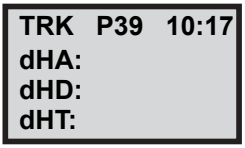


As soon as the prism comes within the measurement beam you will see dHD,i.e. how much you must change the horizontal distance from the instrument.

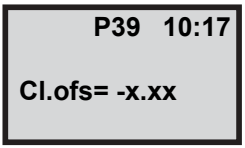
+=increase

-=decrease

When you think that you are close enough to zero, press REG to register the point or press ENT if you wish to set out with the radial/right angle offset method.

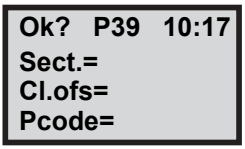


The program suggests the centre line offset for the other road half which is valid for the second definition point. Press ENT.



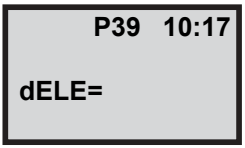
ENT

Is the definition point data OK? If so, press ENT, otherwise press NO. In this case we press ENT.



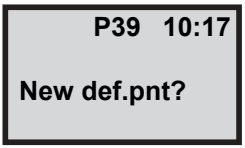
ENT

Here is the difference in height between the first and second reference point. Press Ent.



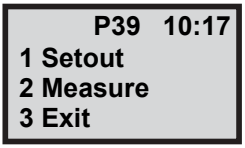
ENT

Do you wish to set out more reference points for another section (station) press ENT and you are able to key in a new section (station) number. In this case we press NO.



NO

Select 1 to set out reference points, 2 to measure reference points or 3 to end program. In this case we select 3 Exit.

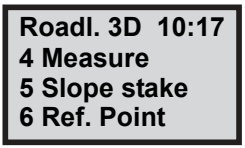


3

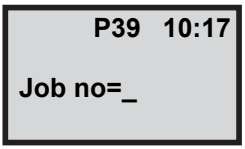
Reference Point - Measure

Select program 39 and press ENT until this display appears.

Select 6 Ref.Point and press ENT.

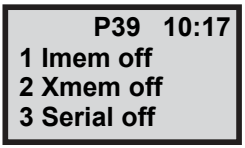


Key in the job file in which you wish to store data for the reference points and press ENT.



Note – *Displayed if Job/Mem is switched on (MNU61)*

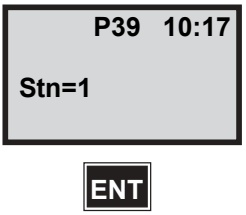
Select in which memory unit you wish to store data and press ENT. In this case we select 1 Imem.



Note – *Only displayed if Job/Mem is switched on (MNU61)*

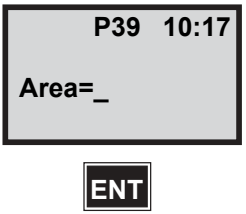
Is this the station you chose when you ran program 20, prior to P39? If no station establishment has been made, P39 will automatically start P20.

It is impossible to start with setting out before you have established your instrument. In this example we accept the station and press ENT.

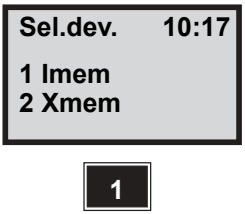


Note – *Only displayed if Stn is switched on (MNU61)*

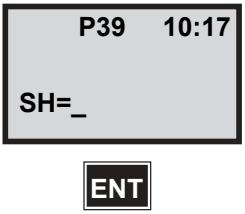
Key in the name of the area file in which the roadline data is stored and press ENT.



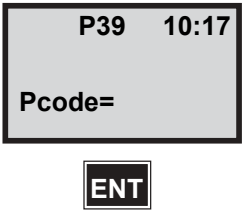
Select in what type of device the roadline data is stored. In this case we choose 1 Imem.



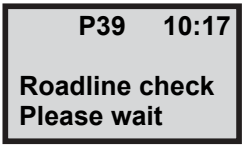
Enter the signal height and press ENT.



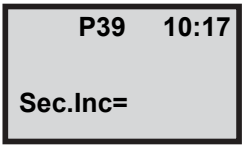
Key in the point code for the definition point that has the correct centre line offset and press ENT, or leave the line blank to enter the centre line offset manually.



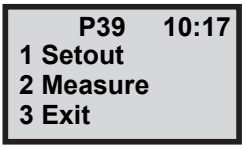
The program checks your chosen roadline. Please wait.



Select which section interval you shall have in this roadline and press ENT. If you chose this interval when you stored the roadline, the program selects that value.

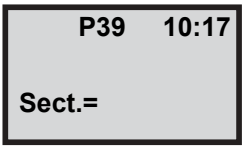


Select 1 to set out reference points, 2 to measure reference points or 3 to end program. In this case we select 2 Measure.

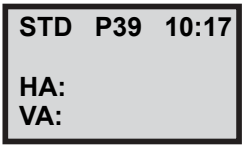


Do you know which section (station) is closest to the point you are about to set out you can key in this and press ENT. Otherwise you leave the line blank and press ENT and let the program calculate the closest section (station) to your

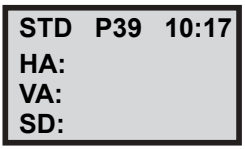
position. See *If you know which section is closest to the point...(cont) page 16-109.*



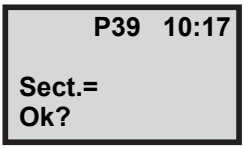
Aim to the prism and press A/M to start the measurement.



When the distance has been measured, press REG to check the point you stand at.

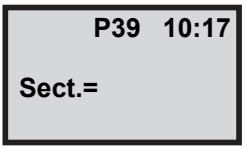


The program suggests a section (station) on the roadline. Accept this section (station) with ENT or press NO to look for another section (station).



ENT

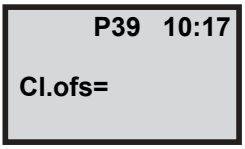
Select an even section (station) or accept the suggested section (station). In this case we accept the suggested section (station) with ENT.



ENT

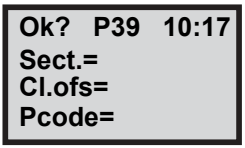
If you know which section is closest to the point...(cont)

If you have keyed in the point code for the definition point the program suggests a centre line offset. Otherwise you will have to key in the correct centre line offset. Press ENT or key in a new value.

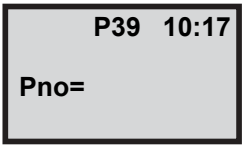


ENT

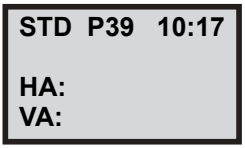
Is the definition point data OK? If so, press ENT, otherwise press NO. In this case we press ENT.



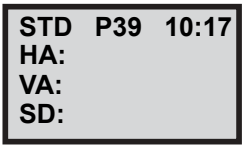
Key in a number for the reference point.



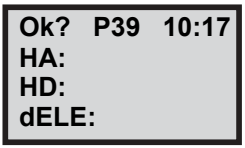
Aim at the prism and press A/M to start the measurement.



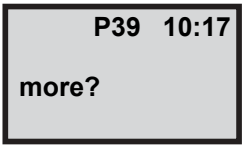
When the prism has been found, press REG to register the measurement.



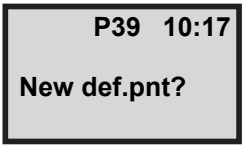
Here you can see the correct bearing for the measured point, the distance and the difference in height from the reference point. Press ENT to accept this or NO to ignore.



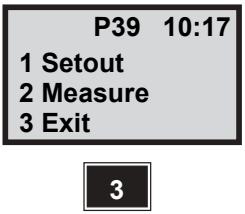
Do you wish to measure more reference points for the current section press ENT and you are able to key in a new point number. In this case we press NO.



Do you wish to measure reference points for another section press ENT. That means that you are able to key in a new section number. In this case we choose to exit with NO.



Select 1 to set out reference points, 2 to measure reference points or 3 to end program. In this case we select 3 Exit.



Registered Data

This list below shows which data will be stored after registration. See the configuration part if you wish to store other data.

Job file	Label	Job file	Label
3 Setout		**5 Slopestake**	
Section	80	Section	80
Centre line offs.	83	Pcode	4
ELE	39	Ht.Ofs.	36
Layer	86	Radofs	72
Layer height	87	RT.ofs	73
Ht.Ofs.	36	dELE	42
dN	40	N	37
dE	41	E	38
dELE	42	ELE	39
4 Measure			
Section	80		
Centre line offs.	83		
dELE	42		
Pcode	4		
Layer	86		
Layer height	87		
N	37		
E	38		
ELE	39		

continue next page...

Job file	Label	Job file	Label
6 Reference pnt		**1 Setout, two ref. points**	
1 Setout, one ref. point		Same data as for one ref. point	
		+	
Section	80	Centre line offs.	83
Centr line offs.	83	dELE	42
Pno	5		
Ht.ofs.	36	**2 Measure**	
Distance	89	Section	80
dN	40	Centr line offs.	83
dE	42	E	39
		Pno	5
		HA	7
		HD	11
		dELE	42

CHAPTER

17

P40 U.D.S.

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- Creation of U.D.S´s 17-3
- Standard Labels 17-3
- Label Types 17-4

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- Choice of Storage Unit 17-17

In General

U.D.S will allow the operator to create own User Defined Sequences for the registration and display of measurement, coding and administrative data. Creation of the sequences is carried out directly from the keyboard of the instrument or transferred from an external device via the serial port.

What advantage can be gained with U.D.S

- It is possible to create and store up to 20 U.D.S´s in the instrument.
- The existence and use of a buffer memory in the instrument allows data to be stacked, which leads to simplified and accelerated data registration.
- It is possible to create and store up to 16 user defined labels (No 84-99) in the instrument.
- Measurement status is always under complete operator control with the help of the automatic display of program prompts in the instrument.
- All labels and values can be duplicated, incremented or decremented automatically. This means that the labels can be registered in a Geodimeter Memory Device (GMD) without even seeing them in the display and without the need to press the ENT key for duplicating and incrementing/decrementing.

Program Generation

Program 40 must be selected in order to create an U.D.S. Once the sequence has been created it is not necessary to run the program 40 in order to access the UDS. It is stored in the memory of the instrument and can be directly accessed by choosing the UDS program number. It will also remain within the instrument until it is deleted or changed by the operator. Program 0-19 are reserved for UDS´s. The sequence is generated by specifying the program No, the order of the desired labels=program prompts and label types. Finally, the label No 79=End must be used to either terminate, loop or link the U.D.S to another U.D.S.

Creation of U.D.S´s

On the next page is a list of Standard Labels. In addition, user defined labels can be set with Program 41. The list and table of label types is not sufficient to explain how and when certain labels and label types are displayed in the instrument during the creation of your U.D.S´s. You simply key in the label´s corresponding number and type in the desired order. In the event of making a mistake during the creation of the U.D.S, the opportunity of correcting the mistake is given by the program asking you to confirm the choice of both label and label type. Your choice of labels and label types is more easily understood when you start to create your own U.D.S´s together with the help of the following examples.

Standard Labels

The label list containing Label 0-83 possess certain functions in Geodimeter CU operation. While creating U.D.S´s, the operator can change the prompt text (P41) but

the function of the label will remain the same. Labels 84-99 are reserved for arbitrary use by the user and can be defined with the program 41, Set Label. Due to the flexibility of the system, almost all label types can be used with all labels. In P0 the only valid are 2, 6, 7, 8. Info 41 is shown if a wrong label type is used.

Label Types

The label type determines the function of the label.

No	Label Type	Description
0	Registration	Collect values directly from the instrument.
1	Prompting label	Enter data manually.
2	Set*	Set values directly in the instrument.
3	Duplicating (auto. or man.)	Display both prompt and the last registered value.
4	In/decrementing (auto. or man.)	Automatic in/decrementing of the previously stored value.
5	Loop/repeat END*	Return to the U.D.S to the first program step.
6	Single Program END*	Return to the U.D.S to P0.
7	Link Program END*	Link the present U.D.S to another U.D.S.
8	View label*	View a value.
9	Call U.D.S-program*	Start another
10	Logon*	Choose memory unit and Job file.

*Can not be stored

0-Registration

Registration of raw and/or calculated values from the instrument. This type of label is chosen when measured and

calculated values can be collected directly from the instrument, e.g. HA, VA, SD, N, E, ELE, HD, VD.

1-Prompting label

Enter data manually after the prompt. The default value of the label will not be displayed.

Note – *For label 21 the only label types that can be used are 1&2*

2-Set

These pre-set values e.g. Label 21=Hor.ref. angle can be set directly in the instrument.

3-Duplicating (automatically or manually)

This label type is used for displaying both the prompt and the last registered value (e.g. SH=0.75). This value can be changed by overwriting or accepted by depressing ENT. The first time you key in the label when you run the U.D.S you are able to choose if the duplication should be automatic or not. If so the next time you enter this program step the label is automatically stored without being displayed.

Note – *If the same label and type exists in UDS that are linked or called upon, the duplication, in/decremention remains.*

4-Incrementing/Decrementing (automatically or manually)

The previously stored value belonging to the same label e.g. Pno=3 is automatically incremented/decremented and can be accepted and stored into instrument either manually or automatically. Displayed values can be overwritten and/or

accepted. The first time you key in the label when you run the U.D.S you are able to choose if the incrementation/decrementation should be automatic or not. If so the next time you enter this program step the label is automatically incremented/decremented and stored without being displayed.

Note – *When using Autodup or Autoincr(decr*

Sometimes you are able to change the ”invisible” values during a U.D.S sequence by using the function key and enter a new value for the label, e.g. F6, ENT, SH=1.0, ENT.

5-Loop/repeat END

Choice of this label type will automatically return the U.D.S to the first program step after registration of the last data items in the measurement sequence.

6-Single Program END

Choice of this label type will return the U.D.S to program 0 after registration of the last data items in the measurement sequence.

7-Link Program END

Choice of this label type will link the present U.D.S to another U.D.S of the operators choice, allowing the field operation to be registered as one complete sequence. Note that in the linked U.D.S the logon procedure will not be run.

8-View Label

This label type is used when you wish to look at certain values without changing them. Useful if you have Auto dup./Auto inc. Note that the values will only show if you

have a measured distance. Change any value with the function key.

9-Call U.D.S

If you choose this label type you are able to start another U.D.S program as a subroutine. When the subprogram is finished you return to the next step in the original U.D.S. You can call upon U.D.S´s in max. 4 levels, otherwise you will get Info 47.

Note – *The labels that are unique in the subprogram will not be reset when you restart the original U.D.S program.*

10-Logon

Choose in which Job file you wish to store the data when you make a registration. This label type can only be accessed when starting the U.D.S from computer. In order to register anything a logon step must be run through otherwise Info 10 will appear when trying to register, link or call.

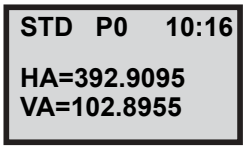
Is this how you would like to set up your own program?

Prog. No	Prompts used in U.D.S	Label No	Label Type	Remarks
1				**Program generation of general project/Job data program**
	Logon		(10)	YES
	Operat	53	3	Value seen, accept or key in new
	Date	51	3	Value taken directly from instrument.
	Time	52	3	-”-
	Temp	56	1	Prompted for and keyed in
	Press	74	1	-”-
	End	79	6	Single program, return to P0
2				**Program generation of inst.stn/Ref.Obj data program**
	Logon		(10)	YES
	Stn	2	1	Prompted for and keyed in
	IH	3	1	-”-
	RefObj	62	1	-”-
	HA ref	21	1	-”-
	End	79	7	Link this program to Prog. 3.
3				**Program generation of survey point data program**
	Pno	5	4	Incr/decr value seen, accept or key in new.
	Pcode	4	3	Duplicated value seen, accept or key in new
	SH	6	3	-”-
	HA	7	0	Value taken directly from instrument
	VA	8	0	-”-
	SD	9	0	-”-
	END	79	5	Prog. loops back to first step in this sequence=Pno

The programs (sequences) on the previous page are only examples of how you could design your field data recording sequences. Normally the surveyor is aware of the different types of projects in which he or she shall be involved and it is therefore possible to design in advance those programs which he or she may need and store them in instrument. In the event of some unusual survey task turning up for which time is no stored program, it is a case of just entering the required sequence into instrument directly in the field.

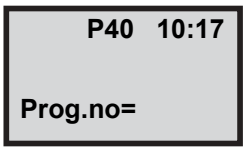
How to use

Select program 40 (U.D.S).



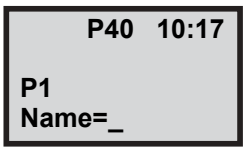
PRG 4 0 ENT

You are now ready to begin with creation of the U.D.S´s 1, 2 and 3 on the previous page. First key in 1 and ENT.



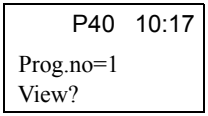
1 ENT

Enter a name for the U.D.S –program. Press the ASCII-key to enter an alphanumerical name (max 16 characters). Press ENT when ready.

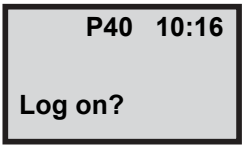


ENT

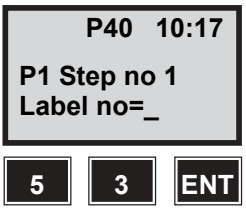
Note – *If the program already exists this question appears. Press YES to view the program or NO and Yes to delete it.*



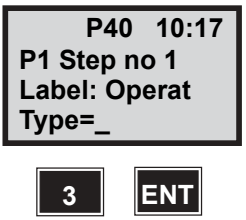
Press YES or ENT to put log on first in the program.



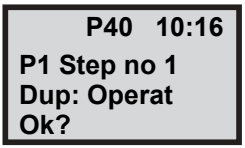
Step 1 is Label No for operator. Key in 53 and ENT.



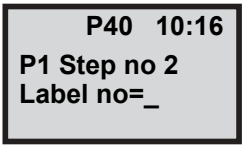
Label type=duplication type (3) as it is often same operator who uses the instrument daily. Key in 3 and press ENT.
If you leave the line blank you will return to the previous menu.



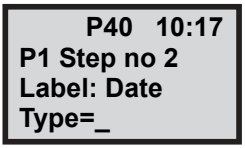
Here you have a chance to change your mind e.g. if you made a mistake with either label choice and/or label type. In this example we press YES.



Label no for Date. Key in 51 and ENT.

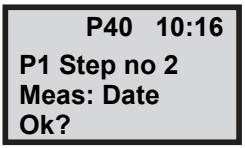


This value will be taken directly from instrument as you have chosen label type 0, you will not need to key in the date. Key in 0 end ENT.



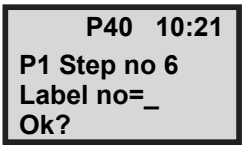
Press YES to accept the label.
Carry on in this manner using the filled in example on page 17-8. If you loose track as to where you are in your

sequence you can easily see this by checking on the step No.

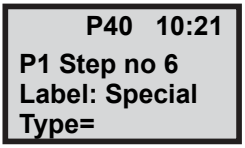


When you come to step No 6 which is the point at which you wish to terminate the sequence, do as follows:

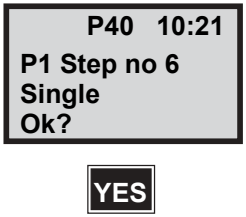
This is equivalent to choosing Label No 79=END. Press only ENT.



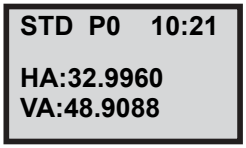
This is the label type for a single nonlinked sequence. Key in 6 and ENT.



Key in YES to accept the label.



You are automatically returned to the program 0. In order to be able to continue with sequence creation it is necessary to choose Program 40 before starting with Program 2.



U.D.S Examples

The design of U.D.S´s is of course dependent on how your existing software accepts data recorded in CU. Formatting possibilities must exist within the system so as to be able to present the recorded and transferred data in a suitable lay out. This may entail some small changes to existing data transfer programs or even the necessity to create some new ones.

Recording of raw data

Prog 1 - General

Label	Text	Type
	Logon	10
53	Operat	3
51	Date	3
52	Time	3
56	Temp	1
74	Press	1
79	END	6

Prog 2 - Stn Est

Label	Text	Type
	Logon	10
2	Stn	1
3	IH	1
62	RefObj	1
21	HAref	1
79	END	7

Prog 3 - Survey with heights

Label	Text	Type
5	Pno	4
4	Pcode	3
6	SH	3
7	HA	0
8	VA	0
9	SD	0
79	END	5

Prog 4 - Survey with no heights

Label	Text	Type
5	Pno	4
4	Pcode	3
7	HA	0
8	VA	0
9	SD	0
79	END	5

Prog 5 - Survey

Label	Text	Type
5	Pno	4
7	HA	0
8	VA	0
9	SD	0
79	END	5

Prog 6 - Survey

Label	Text	Type
7	HA	0
8	VA	0
9	SD	0
79	END	5

Recording of raw data and coordinates

Prog 8 - Survey with heights

Label	Text	Type
4	Pcode	3
5	Pno	4
6	SH	3
7	HA	0
8	VA	0
9	SD	0
37	N	0
38	E	0
39	ELE	0
79	END	5

Prog 8 - Survey with no heights

Label	Text	Type
4	Pcode	3
5	Pno	4
7	HA	0
8	VA	0
9	SD	0
37	N	0
38	E	0
79	END	5

Prog 10 - Survey without heights and Pcode

Label	Text	Type
5	Pno	4
7	HA	0
8	VA	0
9	SD	0
37	N	0
38	E	0
79	END	5

Choice of Storage Unit

If you press YES or ENT at the question ”Log on?” when you create your U.D.S-program, you will be able to choose in which memory unit and in what Job-file all data will be stored when registering.

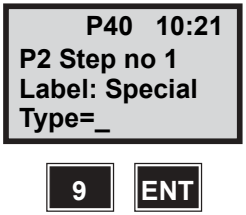
Note – *If this logon routine is not included Info 10 is shown and no registration can be done even if pressing the REG-key.*

Create a subroutine

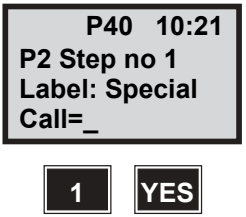
Look at page 17-14. Program 1 is a general U.D.S-program that are useful whenever you want to start a U.D.S sequence. Instead of manually initiating this program you can call upon this program from any of your other U.D.S programs. Simply press ENT and choose type 9, Call (Program 1), at the second step in your U.D.S-program. This means that when you start your U.D.S program, e.g. Program 2, the program automatically initiates program 1, the general U.D.S-program. When the general program is run through you are returned to the next step in program 2.

Enter program 40 and choose to create program 2. Answer YES to logon. At step 1 press ENT.

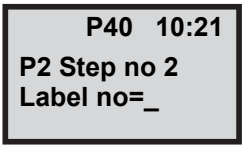
Choose label type 9, Call, and press ENT.



Here you enter the program you want to call. In this example we choose program 1 and press YES (ENT).

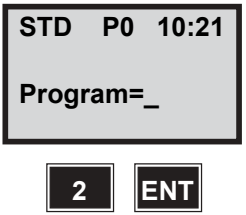


Accept the first program step with YES or ENT. Press NO to re-enter. Continue with the following program steps.

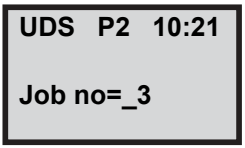


Now lets start program 2 and see how it works.

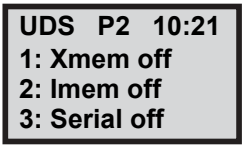
Start program 2.



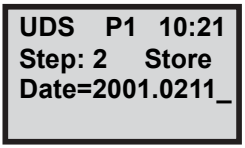
First the program runs through the logon procedure and you choose in which Job file you wish to store the data.



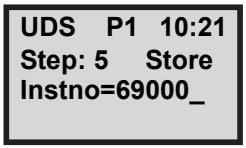
Choose in which memory unit you wish to store the data.



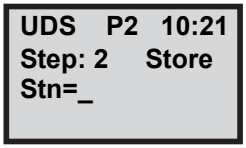
Now the program calls upon program 1.
Enter the general parameters…



This is the last step in program 1.
When you press ENT you will return to step 2 in program 2.



The program will continue step by step to the end of the program.



CHAPTER

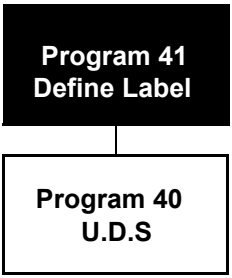
18

P41 Define Label

In General 18-2
How to use 18-3

In General

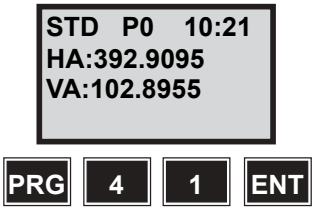
With program 41 you can define label no 84-99. Program 41 – Define Label is included in the following program:



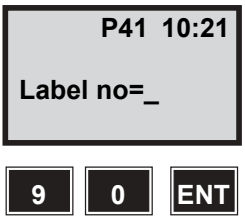
How to use

Turn the instrument on and disengage the dual-axis compensator with function 22.

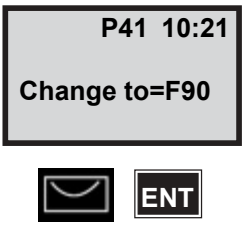
Select program 41 (Define Label).



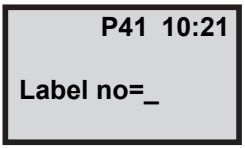
Choose any label between 90-109. In this example we choose 90 and press ENT.



Here you can see any old definition that may exist. Press the ASCII-key to adopt ASCII table and key in the appropriate characters, e.g. 71 68 84 32 78 79 (colour) and press ENT.



When you are ready press only ENT instead of keying in a label no. You will now return to program 0.



CHAPTER

19

P43 Enter Coordinates

In General 19-2
How to use 19-4

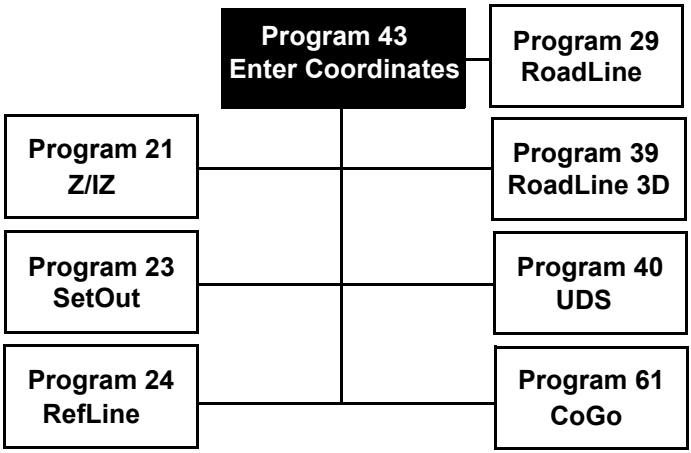
In General

With program 43 you can carry out storage of known coordinates. These known values are stored in an Area file. The data contained in these AREA files will take the format Pno, Pcode, Northing, Easting and Elevation and must be keyed in manually. Coordinates are entered with up to 7 positions and 4 decimals.

Transfer of point coordinates and elevation data banks between computer and Geodimeter CU is carried out with program 54, File transfer, or by sending serial commands. See Geodimeter CU general for more information.

As the total number of Area files is unlimited (device memory capacity is only limitation), the same point numbers can be used as long as they are stored in different Area files. Same point numbers can be stored in the same Area file, however, it is always the point nearest the beginning of the file which is recalled for use in Station Establishment –P20 and SetOut – P23 calculations. If a particular point has to be updated in an Area file, this can be done with Edit, if the software is installed in your instrument.

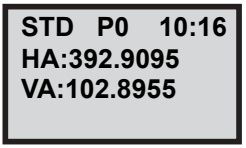
Program 43 – Enter coordinates is included in the following programs:


Program 43
Enter Coordinates
Program 29
RoadLine
Program 21
Z/IZ
Program 39
RoadLine 3D
Program 23
SetOut
Program 40
UDS
Program 24
RefLine
Program 61
CoGo

How to use

Switch on the instrument and go through the Start procedure until the instrument is in theodolite mode.

Select program 43 (Enter Coordinates).

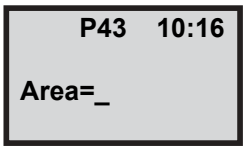


PRG | 4 | 3 | ENT

In which device do you want to store the point coordinates. In this example we choose 1 Imem.

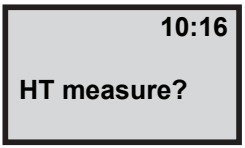
1

Key in the name of the Area file in which you wish to store the point coordinates and height values. In this example we key in 25 and ENT.



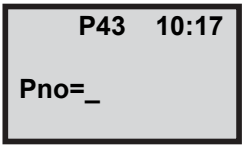
2 | 5 | ENT

Do you want to store heights? In this example we choose to do so. Press YES (ENT) to accept or NO to cancel.



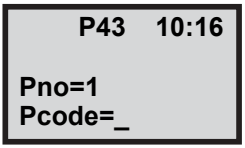
YES

Key in the first point number you wish to store in the Areafile. In this example we key in 1 and ENT.



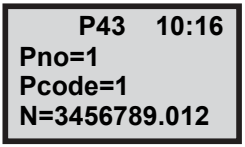
1 ENT

Here you have an opportunity to enter a Pcode for the point. The program will propose the last Pcode entered. Accept it, key in a new or leave it blank.

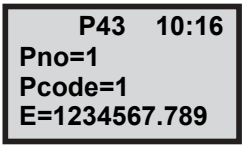


1 ENT

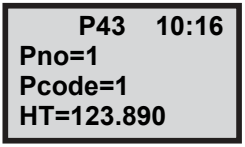
Key in the Northing value of point number 1 and press ENT.



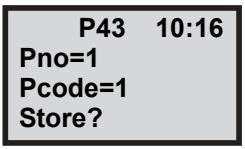
Key in the Easting value of point number 1 and press ENT.



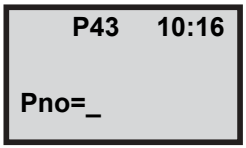
Key in the height of point number 1 and press ENT.



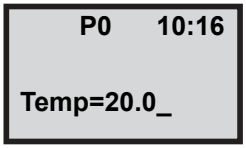
Press YES to store point number 1 or press NO to cancel. In this example we press YES.



Key in the next point number or press only ENT when you are finished. In this example we press ENT.



You are now returned to program 0.



CHAPTER

20

P45 Pcode

In General 20-2
How to use 20-5

In General

Pcode provides the operator with the opportunity of calling upon a point code library which can be directly created from the instrument keyboard. After Pcode library creation and keying in of the Pcode number, the appertaining Pcode name will be displayed either for acceptance or rejection and thereafter recording.

How do I create my very own point code library

This is done simply by choosing the program No 45=Pcode. It then simply becomes a task of keying in the numerical value of the point code followed by its equivalent alpha or alphanumerical title. The instrument automatically adopts the ASCII mode for this purpose and you consult the ASCII table in your instrument user manual for the keying in of the alpha/alphanumerical codes.
Pcode numbers range from 1-254; if Nos above this range are chosen INFO 31 is displayed. The equivalent alpha point code can contain up to 16 characters; in cases where 16 characters are required, the prompt ”Text=” will disappear from the display during the creation of the point code.

Maximum of stored points

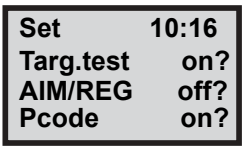
The maximum number of characters which can be stored in the point code library is limited to 800. In other words if all the point codes stored in the library have a maximum number of characters of 16, there would be enough room for 50 point codes. However, as most point codes are abbreviated, the storage room of 800 characters should provide the operator with enough storage place for all point

codes her or she will require for storage of detail point code numbers during e.g. a tacheometric exercise.

Note – *The numeric value of the point code is stored, not the title.*

Activation/deactivation of Pcode

After the installation of Pcode in the instrument, it can be activated or deactivated with the help of menu 6.1-Switches.



This means that if Pcode is set to ON the keying in of a numerical point code in e.g. an U.D.S, will automatically result in the equivalent alpha/alphanumerical point code being displayed in the instrument; its correctness is confirmed by pressing ENT. If wrongly keyed in the point code can be overwritten without having to clear the wrongly chosen one with the CL-key.

There are however some occasions where operators are very experienced and have been working with only numeric Pcodes on field cards for years. On this occasion the Pcode switch can be switched off. The instrument will always adopt the last chosen ON/OFF mode at switch on. The status of the switch can also be seen when keying in one´s first point code number in a U.D.S, i.e. if the point code´s equivalent alpha title is seen in the display after keying in

the numeric code and pressing ENT, then the switch is set to ON.

Note – *In order to correct any wrongly keyed in point code alpha title, so that it corresponds with its numerical point code value, it is necessary to recreate it with the help of Pcode.*

The changing and deletion of wrongly keyed in data and the insertion of a new can of course be carried out with EDIT, if you have access to this software in the instrument.

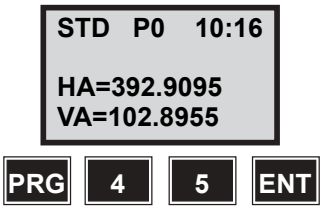
Auto dup, auto incr/decr label types

When using the Auto dup/auto incr/decr feature with Pcodes in U.D.S´s, wrongly keyed in values can be changed without the prompt and its respective value being duplicated in the recording device. This is done by using the F4 function; this function must be used before pressing the REG key. In cases where ordinary Dup and incr/decr label types are used, use of F4 function will result in the Prompt and its respective data being added to the already in-buffer memory recorded data. In other words, the point code data will be duplicated. This can be erased and corrected with EDIT later, if you have access to that particularly software. This applies to all data which has been wrongly recorded while using the Auto dup, Incr/Decr in the connected recording device. So even if you have pressed the REG key, it is never too late to erase and/or change and correct wrongly recorded point code data. Correction of wrong and entry of new Pno and SH values can be treated in the same manner.

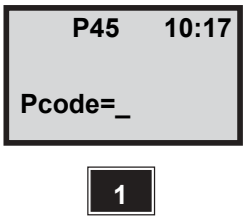
How to use

Switch on the instrument and go through the Start procedure until the instrument is in theodolite mode.

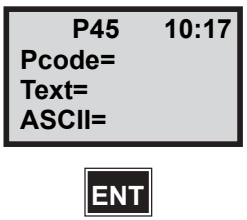
The instrument´s station has been established. Select program 45 (Pcode).



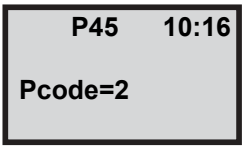
Choose the numerical value of the pcode to which you wish to give an alpha title. In this example we choose 1 and press ENT:



The instrument adopts the ASCII mode, key in the complete alpha title or abbreviated alpha title of the point code. In the example we key in 87 65 76 76=WALL (see the ASCII table).



Continue to create your Pcode library in this way until you have stored all the alpha titles you need. When you are finished, press ENT to return to P0.

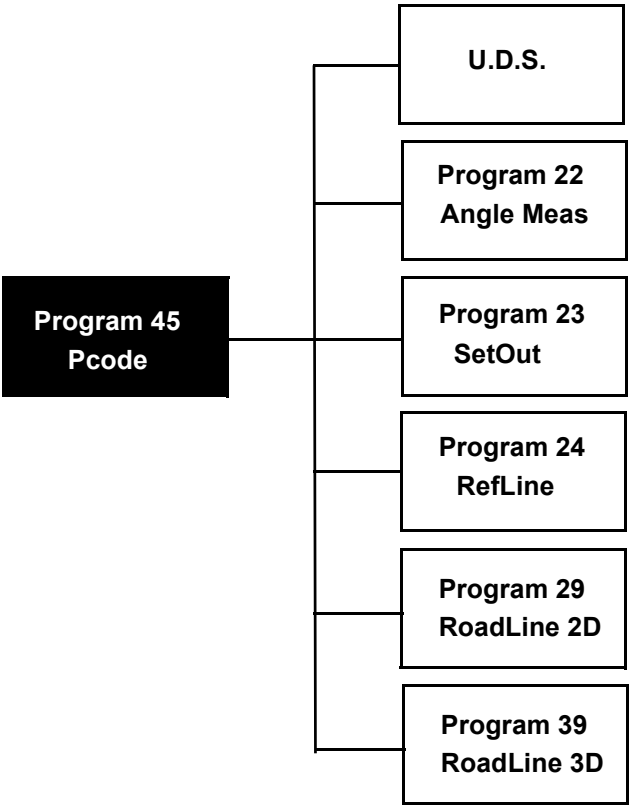


Pcode in U.D.S and other programs

You have now stored, in the memory of the instrument, the necessary alpha titles of most types of survey detail you require to survey in during your tacheometric task. As soon as you have established your instrument over the survey station at which the survey measurements shall be carried out you can take advantage of the alpha and alphanumerical Pcodes stored in your Pcode library. When in the U.D.S, the sequence prompts for the point code corresponding to the type of survey detail which is to be measured and stored, all you do is key in the relevant Pcode´s numerical value. After its display, confirmation of its correctness is done by pressing ENT on the instrument keyboard. Storage into Geodat or any other external device is finalized by pressing the REG key of the instrument after the point has been measured.

Note – *The numeric value of the point code is stored, not the title.*

Pcode can be entered directly in the following programs:


Program 45
Pcode
U.D.S.
Program 22
Angle Meas
Program 23
SetOut
Program 24
RefLine
Program 29
RoadLine 2D
Program 39
RoadLine 3D

CHAPTER

21

P54 File Transfer

In General 21-2
How to use 21-3

In General

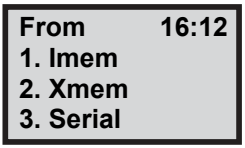
Connect the two units with the appropriate cable and switch them on. The instructions below describes how to transfer files from the Control unit to the Station unit's internal memory:

How to use

Operation at the source unit

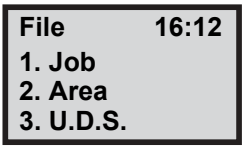
Choose program 54

Choose from which device you want to transfer files. In this example we choose 2 Imem.

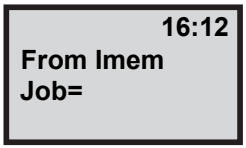


Here you can choose what type of file you want to transfer:

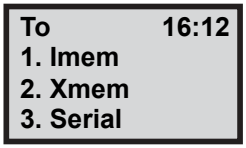
1. A jobfile 2. An areafile or 3 A U.D.S-file.
In this example we choose 1. A jobfile.



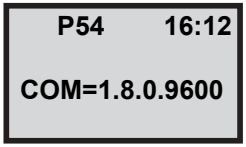
Key in the name of the file. In this example we key in Job=1.



To which device are you going to send the chosen file/s from the source unit. Here we choose 3. serial.

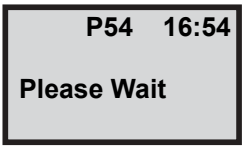


Enter new serial parameters or accept the current. Here we accept the current with enter.



Note – *Prepare the target unit before accepting the serial parameters for a successful file transfer.*

The file/s are sent via the cable and the display shows. “Wait” during the transfer and you will then exit program 54.

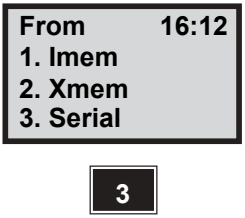


Note – *If info 19 appears during a file transfer that means that the file transfer was not successful. In that case you should run the file transfer again and look for where it fails, that is when info 35 (Data error) will show. Then check your file for any errors and if possible correct them with the editor.*

Operation at the target unit

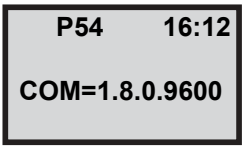
Chose program 54

From which device are you going to send files to the target unit. In this case it is 3. Serial.



Enter the serial parameters which must be same as the serial parameters at the source unit.

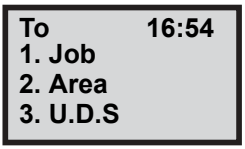
In this example we accept the current with ENT.



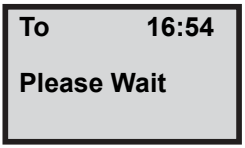
What type of file should the transferred files be saved as:

1. Job, 2. Area or 3. U.D.S.

In this example we choose 1. Job since we are transferring a Jobfile.



The unit is now ready to receive. Start the transfer from the source unit.



CHAPTER

22

P55 Job/Mem

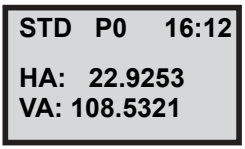
In General 22-2
How to use 22-3

In General

Program 55 will enable the operator to change job name and select memory device to store the job. When a program is started the operator is prompted to key in the job name and select memory if Job/Mem has been activated in MNU 6 1. If Job/Mem has been deactivated in MNU6 1 then program 55 offers a fast way to change job name and/or memory device

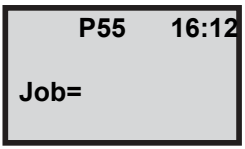
How to use

Select program 55.



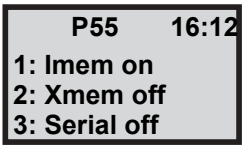
PRG 5 5 ENT

The program will suggest the latest job name press ENT to accept or key in a new name for the job file.



ENT

Select in which memory you want to store the job file. Press ENT to return to program 0.



ENT

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